

UNITED STATES OF AMERICA:
WAR DEPARTMENT.

MONTHLY WEATHER REVIEW.

(GENERAL WEATHER SERVICE OF THE UNITED STATES.)

APRIL, 1887.

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List of merchant marine steam and sailing vessels from which International Simultaneous Meteorological reports were received at the Office of the Chief Signal Officer, U. S. Army, Washington, D. C., in time to be used in the preparation of the Weather Review for the month of April, 1887.

Name of vessel.	Captain.	Name of vessel.	Captain.	Name of vessel.	Captain.
Albia Line.		Miss. & Dominion S. S. Co.		White Star Line.	
Br. s. s. Grecian.....	Capt. C. E. Le Gallies.	Br. s. s. Ontario.....	Capt. W. P. Couch.	Br. s. s. Adriatic.....	Capt. H. Parrell.
Hibernian.....	J. Brown.	Br. s. s. Mars.....	Jos. Giblin.	Br. s. s. Arabic.....	G. Barton.
Manitoba.....	W. Dalziel.	Toronto.....	Jas. McAuley.	Br. s. s. Baltic.....	H. Davison.
Scandinavian.....	John Park.	Vancouver.....	C. J. Linstead.	Br. s. s. Britannic.....	H. Perry.
American Line.		Morgan Line.		Br. s. s. Celtic.....	P. J. Irving.
Br. s. s. British King.....	John Kelly.	Am. s. s. Eureka.....	R. B. Quick.	Br. s. s. Germanic.....	Benj. Glendell.
Br. s. s. British Prince.....	S. Nowell.	National Line.		Br. s. s. Republic.....	P. J. Irving.
Br. s. s. British Princess.....	K. H. Frooth.	Br. s. s. Canada.....	Thos. Foote.	Wilson Line.	
Am. s. s. Illinois.....	G. H. Dodge.	Denmark.....	R. S. Rigby.	Br. s. s. Buffalo.....	J. H. Malet.
Br. s. s. Lord Clive.....	P. Urquhart.	Egypt.....	J. Sumner.	Br. s. s. Chicago.....	H. W. Jones.
Anchor Line.		England.....	T. P. Hooley.	Br. s. s. Galilee.....	R. T. Jones.
Br. s. s. Australia.....	A. McKitchie.	Erin.....	J. Robinson.	Br. s. s. Lepanto.....	T. M. Irvin.
Br. s. s. Albatross.....	J. Brown.	France.....	A. D. Hadley.	Br. s. s. Marengo.....	W. Abbott.
Br. s. s. Alexandria.....	D. Fort.	Greece.....	A. J. Jeffrey.	Br. s. s. Otranto.....	W. Huppeth.
Br. s. s. Bolivia.....	J. J. Smith.	Helvetia.....	G. Cochrane.	Br. s. s. Santiago.....	R. Potter.
Br. s. s. British Crown.....	Archibald Smith.	Holland.....	Wm. Tysan.	Miscellaneous.	
Br. s. s. British Queen.....	E. Wills.	Italy.....	Wm. Pearce.	Nor. s. s. Amicilia.....	F. M. Reimers.
Br. s. s. Cincinnatus.....	A. Campbell.	Spain.....	W. A. Griffiths.	Br. s. s. Angerton.....	G. M. Orr.
Br. s. s. Devonian.....	Hugh Young.	The Queen.....	John Milligan.	Br. s. s. Aurelia.....	G. W. Head.
Br. s. s. Dorian.....	J. McKimble.	Navigazione Generale Italiana.		Br. s. s. Balader.....	J. Ross.
Br. s. s. Elysia.....	W. Baxter.	Br. s. s. Gottardo.....	Domenico Viola.	Br. s. s. Ben Ledi.....	S. Adamson.
Br. s. s. Ethiopia.....	John Wilson.	Br. s. s. Independente.....	F. Prandello.	Br. s. s. Chigwell.....	W. Masters.
Arctur Line.		Br. s. s. Sura.....	G. Caserio.	Br. s. s. Edith Golden.....	J. H. Bennett.
Br. s. s. Critic.....	W. E. Lord.	New York and Cuba Mail S. S. Co.		Br. s. s. El Callao.....	Jos. Scholtz.
Br. s. s. Monte Rosa.....	C. Thomas.	Am. s. s. Cienfuegos.....	F. M. Faircloth.	Br. s. s. Elcano.....	V. de Ipiquia.
Atlas Line.		N. Y., Havana & Mexican Mail S. S. Co.		Br. s. s. Elston.....	T. Robertson.
Br. s. s. Atlas.....	J. W. Saxon.	Am. s. s. City of Alexandria.....	J. W. Reynolds.	Br. s. s. John Dixon.....	L. C. Welch.
Br. s. s. Alvea.....	W. McKay.	City of Washington.....	W. M. Rittig.	Br. s. s. India.....	M. Hulen.
Br. s. s. Andes.....	T. M. MacKnight.	North German Lloyd Steamship Co.		Br. s. s. Light-ship No. 57.....	Andrew Jackson.
Br. s. s. Athen.....	H. Low.	Ger. s. s. Aller.....	H. Christoffers.	Br. s. s. Lorenzo D. Baker.....	Warren F. Wiley.
South's S. S. Co. (Hondur.)		Br. s. s. America.....	H. Hupner.	Br. s. s. Lord O'Neill.....	James Dunn.
Br. s. s. Basil.....	H. Thompson.	Br. s. s. Donau.....	P. H. Herdrow.	Br. s. s. Madrid.....	M. Garson.
Br. s. s. Bernard.....	Ch. Off. S. Richards.	Br. s. s. Elder.....	G. Meyer.	Br. s. s. Mexico.....	M. Carmona.
Br. s. s. Clement.....	Capt. Thos. Burley.	Br. s. s. Elbe.....	Th. Jungst.	Br. s. s. Mozart.....	T. Sawyer.
Br. s. s. Jerome.....	Benj. Crisp.	Br. s. s. Ems.....	H. Ring.	Br. s. s. Peconic.....	G. Evans.
Rodmans Steam Navigation Co.		Br. s. s. Fulda.....	H. Boedcker.	Br. s. s. Pomena.....	J. Legos.
Br. s. s. Chateau Leoville.....	M. Le Chapelain.	Br. s. s. Main.....	H. Richter.	Br. s. s. Prydain.....	M. Parry.
Br. s. s. Chateau Yquem.....	C. F. Journeil.	Br. s. s. Saale.....	W. Willgerod.	Br. s. s. Queen.....	J. Anblison.
Druid City Line.		Br. s. s. Trave.....	R. Busius.	Br. s. s. Roseville.....	J. Dove.
Br. s. s. Brooklyn City.....	W. Fitt.	Br. s. s. Werra.....	H. Bruns.	Br. s. s. Saint Ronans.....	Henry Campbell.
Br. s. s. Jersey City.....	E. Horlor.	Occidental and Oriental Steamship Co.		Br. s. s. Serra.....	F. de Luzarraga.
Br. s. s. Llandan City.....	T. H. Goro.	Br. s. s. Oceania.....	H. Davison.	Br. s. s. Vertumnus.....	C. E. Cook.
Br. s. s. Chaswell Line.....		Ocean Steamship Company.		Br. s. s. Viola.....	L. Murray.
Am. s. s. Louisiana.....	E. V. Gager.	Am. s. s. City of Augusta.....	J. W. Catharine.	New York Herald Weather Service.	
Onward Line.		Oceanic Steamship Company.		Br. s. s. Alene.....	E. J. Selders.
Br. s. s. Auraria.....	W. H. P. Hains.	Am. s. s. Alameda.....	G. H. Morse.	Br. s. s. Alvo.....	D. Williams.
Br. s. s. Bothnia.....	T. Dutton.	Old Dominion Steamship Company.		Br. s. s. Belgravia.....	G. L. Boothly.
Br. s. s. Catalonia.....	Edward Wylie.	Am. s. s. Manhattan.....	Frank Stevens.	Br. s. s. Burgundia.....	L. Dulac.
Br. s. s. Cephalonia.....	Henry Walker.	Oregon Railway and Navigation Co.		Br. s. s. Caracas.....	N. M. Hopkins.
Br. s. s. Etruria.....	T. Cook.	Am. s. s. Columbia.....	Fred Bolles.	Br. s. s. Chateau Lafite.....	C. Ollivier.
Br. s. s. Gallia.....	M. Murphy.	Pacific Coast Steamship Company.		Br. s. s. Chateau Marquax.....	John Deaken.
Br. s. s. Favosin.....	A. McKay.	Am. s. s. City of Chester.....	J. Wallace.	Br. s. s. City of Puebla.....	J. W. Hawthorn.
Br. s. s. Samaria.....	B. Watt.	Br. s. s. Orinaba.....	John N. Ingalls.	Br. s. s. El Monte.....	H. S. Quick.
Br. s. s. Scythia.....	T. Roberts.	Pacific Mail Steamship Company.		Br. s. s. El Paso.....	F. Remble.
Br. s. s. Servia.....	H. McKay.	Am. s. s. City of Para.....	I. Dexter.	Br. s. s. Knickerbocker.....	Crowell.
Br. s. s. Umbria.....	W. McKimble.	Br. s. s. City of Peking.....	H. C. Dearborn.	Br. s. s. Lampasae.....	H. Bernpohl.
Edwards & Co's S. S. Line.		Br. s. s. City of Sydney.....	D. C. Friele.	Br. s. s. Marco Aurelio.....	J. H. Henderson.
Gas. s. s. Amalia.....	Julius Dahr.	Br. s. s. Colima.....	J. M. Caverly.	Br. s. s. Napier.....	J. A. B. Cushing.
Br. s. s. Australia.....	G. Friele.	Br. s. s. Granada.....	J. L. Lockwood.	Br. s. s. Nevada.....	T. P. C. Halsey.
Br. s. s. California.....	O. Winkler.	Br. s. s. Newport.....	W. G. Shackford.	Br. s. s. New Orleans.....	J. B. Perry.
Br. s. s. Poinria.....	Johannes Schude.	Br. s. s. San Blas.....	Thos. Chapman.	Br. s. s. Niagara.....	S. V. Bennis.
Br. s. s. Polynesia.....	A. Kuhn.	Br. s. s. San Jose.....	D. S. Austin.	Br. s. s. Portia.....	Henry Dawson.
Br. s. s. Taormina.....	W. H. Frank.	Quebec Steamship Company.		Br. s. s. Samana.....	W. Taylor.
Purana Line.		Br. s. s. Orinoco.....	G. S. Locke.	Br. s. s. Straits of Gibraltar.....	G. Grigs.
Br. s. s. Borderer.....	F. Manley.	Br. s. s. Red "D" Line.....	J. S. Garvin.	Sailing vessels.	
Br. s. s. Stockholm City.....	K. Doyle.	Am. s. s. Philadelphia.....	Sam. Hess.	Am. bg. Abbie Clifford.....	D. W. Storer.
General Trans-Atlantic Steamship Co.		Br. s. s. Valencia.....	W. Woodrick.	Br. s. s. Adria.....	J. H. Weldon.
Br. s. s. La Bourgogne.....	M. Franguel.	Red Star Line.		Br. s. s. Angelo di Amore.....	M. Travega.
Br. s. s. La Bretagne.....	M. de Jousellin.	Br. s. s. Ned Star Line.....		Br. s. s. Arcot.....	J. W. Cates.
Br. s. s. La Champagne.....	E. Traub.	Br. s. s. Belgienland.....	W. A. Beynon.	Br. s. s. Artemis.....	E. E. Moe.
Br. s. s. La Gascogne.....	U. de Kersabiec.	Br. s. s. Nordland.....	A. J. Griffin.	Br. s. s. August.....	G. H. Jaburg.
Br. s. s. La Normandie.....	U. de Kersabiec.	Br. s. s. Noordland.....	H. E. Nickels.	Br. s. s. Bonny Dool.....	C. Burgess.
Great Western S. S. Line.		Br. s. s. Pennland.....	Bud. Weyer.	Br. s. s. C. B. Church.....	N. A. Anderson.
Br. s. s. Dorset.....	Ch. Off. E. Crossman.	Br. s. s. Rhyland.....	J. C. Jamison.	Br. s. s. Chas. S. Whitney.....	Geo. D. Spicer.
Union Line.		Br. s. s. Switzerland.....	H. Buschmann.	Br. s. s. Comet.....	W. A. Aldrich.
Br. s. s. Alaska.....	Capt. Geo. S. Murray.	Br. s. s. Wexland.....	J. Ueberweg.	Br. s. s. Daisy Boynton.....	C. Harding.
Br. s. s. Arizona.....	S. Brooks.	Br. s. s. Wexland.....	J. Ueberweg.	Br. s. s. Edward H. Emerson.....	A. H. Child.
Br. s. s. Wyoming.....	C. L. Rigby.	Br. s. s. Wexland.....	J. Ueberweg.	Br. s. s. Emilia.....	W. Siens.
Hamburg-American Line.		Br. s. s. Wexland.....	J. Ueberweg.	Br. s. s. Errante.....	A. G. Nicolich.
Br. s. s. Gellert.....	W. Kahlewein.	Netherland Line.		Br. s. s. Est.....	E. Tassinio.
Br. s. s. Gothia.....	C. Kordell.	Br. s. s. Eland.....	Capt. J. H. Taat.	Br. s. s. Ferdinand.....	H. Luitken.
Br. s. s. Hammonia.....	H. F. Schwensen.	Br. s. s. P. Caland.....	F. H. Boujer.	Br. s. s. Fratelli Laurin.....	L. Laurin.
Br. s. s. Hungaria.....	W. Leithauer.	Br. s. s. Rotterdam.....	G. J. Vis.	Br. s. s. Geestemunde.....	F. Leute.
Br. s. s. Lening.....	H. Barends.	Br. s. s. Rotterdam.....	A. Potjer.	Br. s. s. Georg.....	G. Scholtz.
Br. s. s. Moravia.....	O. Penoldt.	Br. s. s. Rotterdam.....	H. v. d. Zee.	Br. s. s. Grondloven.....	O. G. Ellingsen.
Br. s. s. Rhartia.....	B. Kariowa.	Br. s. s. Rotterdam.....	G. V. Vis.	Br. s. s. Helena.....	T. T. Verbeet.
Br. s. s. Rugia.....	A. Alberts.	Royal Mail Steamship Co.		Br. s. s. Hedwig.....	Th. Minnen.
Br. s. s. Slavonia.....	H. Schmidt.	Br. s. s. City of Dallas.....	C. W. Read.	Br. s. s. Henry Waddington.....	W. H. Megees.
Br. s. s. Suevia.....	C. Ludwig.	Br. s. s. Royal West India Mail Steamship Co.		Br. s. s. Hermon.....	O. Olsen.
Br. s. s. Wisland.....	C. Hebach.	Br. s. s. State Line.....	J. A. J. Lacruoy.	Br. s. s. Ida.....	J. Witter.
Harrison Line.		Br. s. s. State of Georgia.....	G. Moodie.	Br. s. s. Jane Adeline.....	G. W. Cates.
Br. s. s. Connellor.....	Wm. Lang.	Br. s. s. State of Indiana.....	A. Ritchie.	Br. s. s. Josephine.....	Chas. Brown.
Isomon Line.		Br. s. s. State of Pennsylvania.....	A. J. A. Mann.	Br. s. s. Jos. E. More.....	Amos Lenhard.
Br. s. s. City of Berlin.....	Francis S. Land.	Br. s. s. State of Nebraska.....	A. G. Brues.	Br. s. s. Komandor Svend Foyen.....	J. Bryde.
Br. s. s. City of Chester.....	A. Lewis.	Br. s. s. State of Nevada.....	J. A. Stewart.	Br. s. s. Leocadia.....	A. Alexander.
Br. s. s. City of Richmond.....	A. Redford.	Br. s. s. Thingvalle Line.....	C. W. Muller.	Br. s. s. L. & W. Armstrong.....	John Stohf.
Br. s. s. City of Montreal.....	R. Leitch.	Br. s. s. Heika.....	A. G. Thomsen.	Br. s. s. Leocadia.....	J. P. Stowens.
Br. s. s. Johnston Line.....	John Inch.	Br. s. s. Island.....	W. Skjott.	Br. s. s. Maggie Abbott.....	D. C. McIntosh.
Lampert & Holt's Steamship Company.		Br. s. s. Thingvalle.....	S. T. H. Laub.	Br. s. s. Manson.....	E. T. Page.
Br. s. s. Basel.....	C. J. Watson.	Br. s. s. Twin Screw Line.....	A. Hyde.	Br. s. s. Mary.....	C. Cates.
Br. s. s. Humboldt.....	Jas. Grimes.	Br. s. s. Richmond H.M.I.....	F. Archer, R.N.R.	Br. s. s. Orion.....	A. Mathieson.
Br. s. s. Humboldt.....	W. Spratly.	Br. s. s. Tower Hill.....		Br. s. s. Palme.....	W. Bahls.
Br. s. s. Others.....	Jas. Clark.	Time and Wear Steamship Co.		Br. s. s. Pearl.....	John B. Zimmer.
Lyland Line.		Br. s. s. City of Newcastle.....	R. Townsend.	Br. s. s. Pillau.....	G. Gerlach.
Br. s. s. Bavaria.....	J. Oseinak.	Br. s. s. United States and Brazil Mail S. S. Co.		Br. s. s. Ralph Hayward.....	J. Baxter.
Br. s. s. Bulgaria.....	E. Parry.	Am. s. s. Advance.....	James Lord.	Br. s. s. Recovery.....	T. E. Blagdon.
Br. s. s. Estria.....	T. H. Fox.	Br. s. s. Alliance.....	J. B. Beers.	Br. s. s. Rodina.....	G. Tomiselli.
Br. s. s. Virginia.....	M. Pitt.	Br. s. s. Warren Line.....	Samuel Walters.	Br. s. s. Sapphira.....	G. W. Murray.
Mullory Line.		Br. s. s. Iowa.....	W. Gleig.	Br. s. s. Sarah.....	L. B. Hale.
Am. s. s. Alamo.....	Sam. Risk.	Br. s. s. Kansas.....	K. Maddox.	Br. s. s. Stephen D. Horton.....	J. Spicer.
Br. s. s. Colorado.....	J. Daniels.	Br. s. s. Norseman.....	J. J. Brarons.	Br. s. s. Teresa Accame.....	G. Boetto.
Br. s. s. Rio Grande.....	J. F. Lewis.	Br. s. s. White Cross Line.....	E. Smit.	Br. s. s. Toivo.....	W. H. Snellman.
Mediterranean & New Ford S. S. Co.		Br. s. s. DeKuyter.....		Br. s. s. Western Chief.....	F. Sander.
Br. s. s. Pontiac.....	Ch. Off. R. Blyth.	Br. s. s. Pieter de Coninck.....		Br. s. s. Winnie Lawry.....	A. McKitchie.
Br. s. s. Pontiac.....	Capt. W. Bowen.			Br. s. s. Winnifred.....	R. Macdonald.

UNITED STATES SIGNAL SERVICE

MONTHLY WEATHER REVIEW.

VOL. XV.

WASHINGTON CITY, APRIL, 1887.

No. 4.

INTRODUCTION.

This REVIEW treats generally the meteorological conditions of the United States and Canada for April, 1887, and is based upon reports of regular and voluntary observers of both countries. Descriptions of the storms which occurred over the north Atlantic Ocean during the month are also given, and their approximate paths shown on chart i, on which also appears the distribution of icebergs and field ice reported. In tracing the centres of the paths of these storms, data from the reports of two hundred and ten vessels have been used. Unusually severe weather prevailed in the trans-Atlantic routes and west of the fortieth meridian during the first and second decades of the month. Dense fog prevailed during a considerable portion of the month along the southern edge of the ice region.

On chart i for this month are traced over the United States and Canada the paths of thirteen areas of low pressure; the average number for April during the past fourteen years is 10.3. The depression of the 22-23d in its progress from the Indian Territory to northern Michigan was accompanied, especially in Kentucky, southern Indiana, and Ohio, by unusually severe thunder-storms and heavy rains, with tornadoes at widely separated points in various parts of the country; in the upper lake region heavy snow and high wind prevailed. The depression which was central in the Ohio Valley on the morning of the 18th was attended in that and surrounding districts by an unusually heavy snowfall for the season.

The mean pressure of the month is very nearly normal in all districts, except Michigan, Wisconsin, Minnesota, and Dakota, where departures as large as .10 below occur.

No considerable departure from the normal temperature

occurs in any district except the central Mississippi and lower Missouri valleys, where the month has been from 2°.0 to 5°.9 warmer than the average April. In the Lake region and along the Atlantic coast the temperature is slightly below normal, in the central and western districts generally slightly above.

In the southeastern quarter of the country very little rain has fallen, the region of greatest deficiency extending from central Texas eastward to the south Atlantic coast.

In the preparation of this REVIEW the following data, received up to May 20, 1887, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and thirty-three Signal Service stations and twenty-four Canadian stations, as telegraphed to this office; one hundred and sixty-four monthly journals; one hundred and sixty-five monthly means from Signal Service stations; twenty-four monthly means from Canadian stations; two hundred and eighty-four monthly registers from voluntary observers; fifty-five monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Alabama, Arkansas, Illinois, Indiana, Kansas, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New England, New Jersey, North Carolina, Ohio, South Carolina, and Tennessee; and of the Central Pacific Railway Company; trustworthy newspaper extracts, and special reports.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean pressure for April, 1887, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii.

The area of highest pressure covers the greater part of the north Pacific coast region and is bounded by the isobar of 30.05; within this line the mean pressure of the month varies from 30.07 at Olympia, Wash., to 30.10 at Roseburg, Oregon. From this isobar the pressure decreases in all directions, except to the westward, until in the central districts of the country the comparatively low pressure of 29.90 and less is reached. From the central districts eastward it increases, attaining in the south Atlantic and east Gulf states a mean of 30.05 or above. In Maine and the adjacent Canadian Provinces the pressure is comparatively low, ranging from 29.86 at Sydney, Cape Breton Island, to 29.94 at Portland, Me. In the plateau region and eastern slope of the Rocky Mountains the pressure is also low as compared with districts in the southeastern quarter of the country and on the Pacific slope.

The departures from the normal pressure are given in the table of miscellaneous meteorological data, and are also shown on chart iv by lines connecting stations of equal departure. In New England, the middle Atlantic states, and lower lake region the pressure of the month is about normal, small departures

both above and below occurring in these districts; from thence westward, north of the fortieth parallel, as far as the eastern boundary of Idaho and Utah it is below the normal; in the upper lake region, Minnesota, Wisconsin, and Dakota the deficiency is quite large, the mean pressure at a number of stations being .10 or more below the normal. In all parts of the country south of the fortieth parallel the pressure is generally slightly above the normal, but the excess is very small, except in southeastern Texas where departures as large as .07 and .09 occur. In California the pressure is about normal; on the north Pacific coast excesses varying from .04 in the northern part of Washington Territory to .08 in southern Oregon occur.

As compared with the pressure of the preceding month, March, 1887, a very large decrease occurs in all parts of the country, except New England, the Atlantic states, and Florida. In the Missouri and upper Mississippi valleys the pressure for April is .20 to .26 below that of March. Along the Atlantic coast the pressure is above that of the preceding month, .10 and over in New England and the Canadian Maritime Provinces, and .01 to .06 in the more southerly districts. In Florida, the east Gulf states, and the north Pacific coast the mean pressure of the two months is about the same.

BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are given in the table of miscellaneous data. The largest ranges occur in the northeastern quarter of the country; the smallest in Florida, the Gulf States, Arizona, and California. In the Lake region, and over the country east of the Mississippi River, the barometer attained its greatest height on the 8th or 9th and reached its lowest readings on the 18th or 29th. At stations in the Missouri and upper Mississippi valleys the barometer reached its lowest point on the 22d or 30th. The following are some of the extreme ranges:

Greatest.		Least.	
	Inch.		Inch.
Mount Washington, N. H.	1.71	San Diego, Cal.	0.30
Albany, N. Y.	1.58	Yuma, Ariz.	0.35
Boston, Mass.	1.55	Los Angeles, Cal.	0.36
New Haven, Conn.	1.54	Key West, Fla.	0.36
Portland, Me.	1.53	Fort Grant, Ariz.	0.40
Block Island, N. I.	1.53	Prescott, Ariz.	0.54
New London, Conn.	1.53	Cedar Keys, Fla.	0.54

AREAS OF HIGH PRESSURE.

Seven well-defined areas of high pressure were observed during April. Four were first observed on the Pacific coast; two appeared to the north of Montana, and one was central over the Saint Lawrence Valley at the opening of the month, it having previously passed eastward north of the United States. The general direction of movement of these areas was to the northward along the coast line when central west of the Rocky Mountains, this northerly movement continuing until the centre reached the forty-fifth or fiftieth parallel, where the general course changed to southeasterly. Four areas of high pressure were traced to the southeast from the northern Rocky Mountain region over the eastern slope. After reaching the central valleys their courses changed to easterly and inclined slightly to the north, this inclination increasing as the high areas approached the Atlantic coast line. Three areas of high pressure apparently disappeared within the region of observation, or before reaching the coast, and only two of the seven areas observed during the month passed over the Atlantic.

I and II.—The first telegraphic weather chart of the month exhibited two areas of high pressure—one extending over the Maritime Provinces, and the other central on the Pacific apparently to the west of central California, but extending well to the eastward over the plateau regions. The first of these high areas passed to the eastward during the 1st and disappeared rapidly during the 2d in advance of the severe storm from the south Atlantic coast which reached Nova Scotia by the 10 p. m. report of the 2d. During the 1st, 2d, and 3d the area of high pressure (ii) referred to as central over the Pacific moved slowly northward along the Pacific coast or probably to the northeast from the Pacific, the reports from coast stations indicating that the centre of greatest pressure was far to the west of the coast line until the 3d. While this area covered the north Pacific coast a secondary area of high pressure appeared to the north of Dakota and, extending southward, apparently united with this area on the 4th on the central slope of the Rocky Mountains. After these areas united the southeast movement continued, carrying the centre to the Mississippi Valley near the mouth of the Missouri River on the morning of the 5th. At this point the direction changed to the northeast and it passed over the lower lakes during the 6th and 7th, being central in New England on the morning of the 8th. This area extended southward during the 9th and 10th, covering the entire coast, but the pressure at the centre decreased with the southerly movement, and it finally disappeared by gradual decrease of pressure while central in the south Atlantic states on the 11th, after having crossed the continent and being under observation ten days.

III.—On the afternoon of the 10th this area of high pressure appeared north of Dakota. It was central north of, and near,

Lake Superior on the morning of the 11th, after which it moved eastward to the Saint Lawrence Valley, where it remained almost stationary during the 12th, 13th, and 14th, and disappeared without passing beyond the stations. The pressure increased at the centre of this area with the easterly movement until the 14th, when the pressure declined, without any apparent motion of translation.

IV.—When the preceding area extended over the Saint Lawrence Valley, high area number iv was approaching the northern California coast from the west. On the 13th it was located to the southwest of Oregon; on the 14th it passed to the east of the coast line and was central in Washington Territory, from which point it passed southeastward to Dakota and thence moved northeastward over Manitoba, being last located as central near Fort Garry on the morning of the 16th. The curve showing the direction pursued by the centre of this area is of the same general character, but less extended, as those traced across the entire continent.

V.—This was a slight area of high pressure which was observed in the northern Rocky Mountain region on the 19th. It extended over the middle and southern Rocky Mountain slopes on the 20th, and over the Atlantic coast states on the 21st, the pressure not exceeding 30.3 at any time within its limits, and generally it was below 30.2.

VI.—When the preceding area was central on the middle Rocky Mountain slope number vi appeared to the west of California on the afternoon of the 20th. The pressure increased at the northern Pacific coast stations during the 21st and 22d, and this area remained almost stationary in this region until the 25th, when it disappeared.

VII.—This area appeared to the west of Oregon on the 30th and extended over the north Pacific coast at the close of the month.

The northerly movement of high areas on the Pacific coast during this month is a feature to be considered in connection with the Pacific coast weather predictions. The only case observed during the month of a high area appearing to the north was that observed on the last day of the month, and the charts for May show that while the pressure increased to the southward the general movement was first to the northeast and then to the southeast.

AREAS OF LOW PRESSURE.

Thirteen areas of low pressure have been traced upon the tri-daily weather charts of April, 1887. Of these, six probably originated to the west of the Rocky Mountains north of the forty-fifth parallel. Four were first observed in the southern or central Rocky Mountain regions, and two apparently developed in the Gulf of Mexico, or on the Florida coast. The last storm of the month had its origin to the north of Montana, and during the 29th and 30th moved almost directly southward along the Missouri Valley. The most marked feature of this storm was the sudden change of direction of movement from southward to northward, thus carrying the storm-centre out of the limits of observation to the west of Lake Superior.

The following table shows the latitude and longitude in which each area of low pressure was first and last observed and the average hourly velocity of each:

Areas of low pressure.	First observed.		Last observed.		Average progress in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
No. I.	50 00	123 00	50 00	98 00	37.0
II.	29 00	79 00	47 00	61 00	40.0
III.	39 00	103 00	45 00	66 00	30.0
IV.	53 00	116 00	49 00	104 00	25.0
V.	53 00	116 00	53 00	102 00	25.0
VI.	40 00	109 00	49 00	85 00	30.0
VII.	47 00	116 00	43 00	97 00	23.0
VIII.	32 00	104 00	45 00	75 00	23.0
IX.	33 00	105 00	43 00	92 00	35.0
X.	47 00	117 00	47 00	51 00	34.0
XI.	27 00	90 00	47 00	62 00	45.0
XII.	53 00	113 00	45 00	70 00	25.0
XIII.	53 00	105 00	43 00	100 00	25.0

Mean hourly progress, 31.1 miles.

I.—This low area was central north of Washington Territory on the morning of the 1st, and moved directly east, with but little energy, crossing the Rocky Mountains north of Montana, and disappearing while central over Manitoba, leaving an extended trough of low pressure to the southward, covering the region from the upper lakes to Arizona. Within this extended depression developed the low area described in this REVIEW as number iii.

II.—This storm probably had its origin in the Gulf or near the Florida coast line; it did not develop much force until the centre reached the middle Atlantic coast. The movement to the northeast was unusually rapid, and the intensity of the storm increased until it passed over Nova Scotia, the most severe gales occurring on or near the New England coast during the night of the 2d. The lowest barometer reported at land stations was 28.93 at Halifax, Nova Scotia, on the morning of the 3d, although vessel reports show still lower readings near the centre of disturbance when the latter was near the New England coast. This storm was confined to the immediate coast, but the cold northerly winds of the north and west quadrants were accompanied by light snows as far south as South Carolina on the 1st, and along the middle Atlantic and New England coasts on the 2d, the snows increasing and becoming heavy in northern New England.

The following notes from Signal Service observers relate to this storm:

Kitty Hawk, N. C.: continuous heavy rain and strong northeasterly wind prevailed on the 1st. At 8.10 p. m. a velocity of forty-five miles per hour was recorded. On the 2d light snow fell for a few minutes in the early morning; wind northwest veering to westerly.

Block Island, R. I.: light snow fell in the early morning of the 1st and continued until 3.30 p. m., followed by cloudy weather and northeast winds which increased to a gale of forty miles per hour. During the storm the schooner "Pathfinder" was driven ashore and became a total loss. On the 2d the gale continued, wind northeast backing to northwest, maximum velocity fifty-six miles per hour. Heavy snow fell during the greater part of the day.

Vineyard Haven, Mass.: heavy snow or rain, with high northeasterly winds, prevailed during the 1st; on the 2d the wind blew with increasing force, prostrating telegraph poles and blowing ashore at this point ten vessels, some of which were considerably damaged.

Wood's Holl, Mass.: northeasterly winds and heavy snow prevailed during the night of the 1st-2d and continued until 4.30 a. m. of the 3d; estimated maximum velocity of wind, seventy miles per hour. The snow drifted in places to a depth of six feet.

Nantucket, Mass.: heavy snow and rain, with high easterly and northeasterly winds, prevailed on the 1st and 2d; maximum velocity of the wind, fifty-three miles per hour, on the 2d. A number of telegraph poles were blown down and the schooner "Mattie W. Atwood" driven ashore.

Eastport, Me.: on the 2d the mercury fell rapidly, temperature steady; at 9.35 a. m. snow began falling, and changed to sleet at 6 p. m. A heavy northeasterly gale prevailed during the entire day, reaching at 6.20 p. m. a velocity of fifty miles per hour; gale ended at 11.40 a. m. of 3d.

III.—On the 2d the pressure was unusually low in the Rocky Mountain districts and thence northeastward to the upper lake region during the presence of low area described as number ii, and by 7 a. m. of the 3d this disturbance was clearly defined as central in eastern Kansas, the low area to the north having been replaced by a rapid increase of pressure in the upper Missouri valley and Manitoba. From eastern Kansas the course of the centre of this low area was to the northeast over the upper lake region, the disturbance increasing in energy and diminishing in area as it approached, the most rapid barometric gradient being in the west quadrants, owing to the rapid increase of pressure to the westward and a decrease of pressure at the centre as the storm moved to the eastward. It passed eastward of the upper lakes on the 4th, followed by severe westerly gales and light snows; the centre apparently crossed the Saint Lawrence River near Quebec during the night of the 4th, moved thence slowly to the northeastward, accompanied in the Maritime Provinces by severe gales, which continued during the 5th and 6th.

The following notes show the severity of this storm:

Des Moines, Iowa: on the 2d the barometer fell rapidly, but pleasant weather prevailed; on the 3d the mercury rose as rapidly; the wind changed to northwest and blew a gale of thirty-two miles per hour. Snow fell for fifteen minutes between 3 and 4 p. m.

Chicago, Ill.: at 8.35 p. m. of the 3d a southerly gale set in and continued until midnight; greatest velocity twenty-five miles per hour. On the 4th the wind blew a gale from the west or northwest until 7 p. m.; greatest velocity thirty-eight miles. Heavy snow fell from noon until midnight.

Mackinaw City, Mich.: an easterly gale, with rain and hail at intervals, prevailed during the night of the 3d-4th; at 6.35 a. m. the wind subsided and shifted from east to southwest. At 7.15 a. m. it began blowing with increasing force, and during the afternoon gradually shifted to west and northwest; maximum velocity of the 4th, forty-four miles per hour, from the east, at 3.45 a. m. Snow fell from 7.15 a. m. until 11.45 p. m. The gale continued until 6.30 a. m. of the 5th.

Milwaukee, Wis.: on the 4th light snow fell from 7.45 a. m. to 4.45 p. m. and from 7.10 to 7.45 p. m. At 1 a. m. a northwesterly gale set in and continued until 10.30 p. m., attaining at 5.47 a. m. a velocity of forty-four miles per hour. The high wind destroyed a number of signs, windows, etc.

Buffalo, N. Y.: cloudy weather and low, rising barometer prevailed on the 4th. A gale from the southwest set in at 1.30 a. m., and reached at 11.40 a. m. the velocity of thirty-five miles per hour. On the 5th the barometer continued rising, temperature falling rapidly, wind veering toward the west and blowing a gale until 8.20 p. m.; maximum velocity, forty-four miles per hour, at 2.55 a. m. Light snow fell from 9.40 a. m. and until 3.20 p. m.

IV.—This disturbance probably originated in the north Pacific, but its centre was first located at 10 p. m. of the 4th north of Idaho. At this report the barometer continued low on the north Pacific coast, and the charts indicate that this was a secondary depression which formed to the eastward of the coast range. During the 5th it passed eastward along the fiftieth parallel to northern Dakota, after which it disappeared by a gradual increase of pressure without further easterly movement, and causing no marked atmospheric disturbance while within the limits of the stations of observation.

V.—This disturbance also originated in the Pacific, but it has not been traced to the westward of the Rocky Mountain range. It was at no time central south of the northern boundary of the United States, and passed eastward from the region north of Montana during the 6th and 7th, disappearing to the north of Dakota after reaching the one hundred and second meridian, leaving an extended area of low pressure in the central Rocky Mountain regions, within which developed the disturbance described as number vi.

VI.—On the afternoon of the 8th a barometric trough extended from Minnesota southwestward to Utah, and also to the northward over Manitoba. This condition continued until the morning of the 9th, when a well-defined area of low pressure extended from Colorado northward to western Dakota. By midnight of the 9th the centre of disturbance had reached eastern Dakota, accompanied by severe local storms and general rains in the upper Missouri valley and Dakota. After passing northeast of Minnesota it apparently united with an extended area of low pressure then covering the Saint Lawrence Valley, but its centre could not be located after passing to the eastward of Lake Superior.

VII.—The telegraphic report at 10 p. m. of the 9th showed that the barometric pressure over the plateau region was from .2 to .4 below the normal, the region of lowest pressure being the eastern portion of Washington Territory and Oregon. The succeeding reports of the 10th indicate a southeasterly movement, and by midnight the centre of disturbance had reached eastern Colorado, where the pressure was below 29.5, the isobars bounding the disturbance extending to the northeast in the direction of an area of high pressure which was then north of Minnesota. This high area moved southeastward over the Lake region, and, after retarding the movements of low-area vii, caused it to disappear in the Missouri Valley by a gradual increase of pressure. When this disturbance was central in western Colorado on the afternoon of the 10th the barometer at the centre was below 29.4; the gradient was rapid to the northeast and southeast and very high winds were reported from Texas northward to Nebraska, giving indications of the approach of a storm of considerable energy, but the succeeding reports show that it did not materially change the weather conditions east of the Mississippi.

The following notes from observers relate to weather conditions prevailing during the presence of low areas vi and vii:

North Platte, Nebr.: on the 8th brisk to high south and southeast winds pre-

vailed, attaining at 2.40 p. m. a velocity of forty miles per hour. The weather was warm and oppressive, and, owing to the dry state of the soil, dense clouds of sand and dust filled the air. During the 9th and 10th the wind continued, blowing a gale from the south and southeast, reaching a maximum velocity of fifty-two miles per hour on the 9th and forty on the 10th. On the night of the 10-11th the gale was accompanied by a heavy thunder-storm, and the wind attained a velocity of fifty miles per hour, blowing down chimneys, wind mills, telegraph poles, etc.

Yankton, Dak.: on the 8th clear weather and high temperature prevailed, with high southerly winds, which attained a velocity of forty-three miles per hour. On the 9th the southerly wind reached a maximum velocity of forty-six miles per hour, and was accompanied by clouds of dust.

Moorhead, Minn.: on the 7th a southeasterly gale set in at 8.30 a. m. and continued throughout the day, and until 4.15 p. m. of the 8th, maximum velocity forty-six miles per hour. Shortly after noon of the 9th the wind again became high, blowing from the south with a maximum velocity of forty-six miles per hour; the gale ended at 7 p. m. During the afternoon, while the gale was at its height, a thunder-storm, with heavy rain, began; several houses were struck by lightning. A number of chimneys and roofs were blown off by the gale.

Marquette, Mich.: during the night of the 8-9th the wind blew hard from the southwest, reaching at 4.26 a. m. a velocity of thirty-seven miles per hour; at 7.57 a. m. of the 9th the wind changed to west and attained a maximum velocity of thirty-two miles. Warm weather prevailed, highest temperature, 82°. On the 10th also the wind blew hard from the west.

VIII.—This depression developed in western Texas, where it was first located on the morning of the 12th. It first moved directly northward to Colorado, where it was located on the morning of the 13th, and thence to southeastern Dakota, which point it reached on the morning of the 14th, and where the course changed to the eastward, passing over Iowa and northern Illinois during the 14th, causing general rains near the centre of disturbance throughout its entire course. The rains extended southward over Missouri and Arkansas, and over the states north of the Ohio River. The centre of disturbance passed eastward of Lake Huron during the 15th, and the rain extended eastward to the Atlantic coast. After reaching the Saint Lawrence Valley near Montreal a secondary disturbance developed on the middle Atlantic coast and moved northeastward along the coast parallel to the coast line, developing considerable energy off the New England coast during the 16th. After the formation of this secondary depression the primary area in the Saint Lawrence Valley immediately disappeared.

IX.—This disturbance also developed in the Southwest, and was probably central in New Mexico on the afternoon of the 16th. It moved eastward over Texas and Arkansas to the central Mississippi valley on the 17th, causing general rains in the region of drought in northern Texas. The rains extended eastward over the Southern States and Ohio Valley during the 18th, and snows were reported from New England westward to northern Indiana. This disturbance apparently reached its maximum energy while passing over Kentucky and West Virginia. On the morning of the 18th, when the centre of disturbance was near Louisville, Ky., the barometer fell to 29.31, and on the afternoon of the 18th the barometer fell to 29.27 at Pittsburg, Pa. The rains were very heavy in Tennessee and the Ohio Valley, and destructive local storms occurred in West Virginia and adjoining states during the 17th and 18th. The centre of disturbance apparently moved over Virginia, and after reaching the Atlantic coast near Norfolk, Va., it passed rapidly to the northeast, causing severe northeasterly gales along the middle Atlantic and New England coasts during the 18th and 19th.

The following, selected from a number of similar notes, will serve to show the character of this storm:

Sandusky, Ohio: brisk variable winds and cloudy weather prevailed on the 17th. On the 18th hail began falling at 2.30 a. m.; at 7.30 the precipitation changed to heavy snow which fell all day, accompanied by high winds from the east in the morning, backing to northerly in the afternoon. The snow and gale ended at 5.45 p. m. The storm did considerable damage to wharves, and several washouts on the railroads along the bay and lake were reported.

Toledo, Ohio: a heavy northeasterly wind set in at 1.55 a. m. of the 18th, barometer falling very rapidly. At 3.16 a. m. the wind reached a velocity of twenty-seven miles per hour; at 5 a. m. thirty-six miles, at which rate it continued until 7.30 a. m., when, increasing, it reached its maximum velocity, fifty-two miles per hour, at 8.25 a. m. The wind continued high until 5.58 p. m. Snow fell during the greater part of the day. Several fences and signs were blown down, and a yacht was broken from her anchorage and capsized.

Nashville, Tenn.: on the 18th the pressure fell until 5.40 a. m. when it

stood at 29.40; at 6.40 a. m. the pressure began rising rapidly. Heavy rain fell during the greater part of the day, with brisk wind veering from south to southwest, and at 5.35 a. m. to west; maximum velocity twenty-seven miles per hour. At Chattanooga the storm was more severe; in the early morning a thunder-storm and destructive tornado occurred, damaging property to the extent of \$6,000. High southwest and westerly winds continued until 8 p. m.

Knoxville, Tenn.: a heavy rain storm, with thunder and lightning and high southwesterly winds, set in during the early morning of the 18th and continued until 7.15 a. m.; maximum velocity of the wind thirty-six miles per hour.

X.—This area of low pressure was central in the eastern portion of Washington Territory on the morning of the 20th. It moved first directly eastward, crossing the Rocky Mountain range in Montana, and afterwards to the southeastward. After the midnight report of the 20th the area of low pressure became extended, and a secondary formation was observed in southwestern Kansas on the afternoon of the 21st while the original disturbance was central in southwestern Dakota. The area of low pressure to the southward developed great energy, and moved northeastward over the upper lake region during the 22d and 23d, while the area to the northward disappeared by an increase of pressure. Destructive tornadoes occurred in Missouri, Kansas, and Arkansas on the night of the 21st, in the southeast quadrant of this storm. The rain-area extended over the greater portion of the United States east of the Rocky Mountains, the heaviest rains occurring in Tennessee, the lower Ohio valley, and in southern Missouri. The barometer fell at the centre of this disturbance as the area moved eastward over the upper lake region, and the minimum pressure, 29.07, was observed at Mackinaw City, Mich., on the morning of the 23d, when the centre was near that station. It disappeared over the Saint Lawrence Valley on the 23d, followed by cold and freezing weather in the Northwest.

The following notes from observers are of interest:

Chattanooga, Tenn.: a thunder-storm, with heavy and light rain and low pressure, prevailed from 8.20 p. m. of the 21st until the early morning of the 23d. On the 22d the rainfall was heavy. At 6 p. m. the wind veered from south to northwest; at 6.45, from northwest to east; at 8.15, from east to south; and at 9 p. m., from south to southwest.

La Crosse, Wis.: the barometer fell rapidly during the night of the 21st-22d; weather threatening, wind shifting to east, and becoming fresh. During the afternoon a heavy thunder-storm, with high northerly wind, occurred. The gale continued until 10.15 a. m. of the 23d; maximum velocity, forty miles per hour. Snow fell during the night of the 22-23d.

Mackinaw City, Mich.: on the 22d the barometer fell rapidly, temperature stationary, light rain from 10 a. m. until 7.30 p. m., when it began falling heavily. At 11 a. m. an easterly gale set in and continued throughout the day, maximum velocity, forty-four miles, at 6.15 p. m. Dense fog prevailed from 9 p. m. until midnight. Snow fell during the greater part of the 23d. At 9 a. m. the wind shifted to southwest, afterward to northwest, and blew a gale, attaining at 3 p. m. a velocity of thirty-four miles per hour.

XI.—The centre of this disturbance is approximately located in the Gulf of Mexico, to the south of New Orleans, La., on the night of the 24th. It was a disturbance of slight energy and not clearly defined, except as an area of rain, until it reached the middle Atlantic coast at midnight of the 25th, when northerly gales were reported from Chincoteague, Va. It passed rapidly along the middle Atlantic and New England coasts and Nova Scotia during the 25th, causing severe gales, and apparently increasing in energy until it passed northeast of the Maritime Provinces.

XII.—This storm was central far to the north of Montana on the afternoon of the 26th, and it probably developed to the west of the Rocky Mountains. On the morning of the 28th it was central north of Dakota, the barometer being below 29.30 at Q'Appelle, Northwest Territory, near the centre of disturbance. The southeasterly movement of this depression continued until the centre reached Lake Erie on the afternoon of the 28th. General rains prevailed east of the Mississippi as far south as the Gulf States on the 28th. After reaching Lake Erie the course changed to the eastward and the disturbance passed over New York and New England, the storm apparently reaching its maximum energy on the New England coast during the night of the 29th. A marked feature in the movement of this depression was the sudden change of direction to the northward after reaching the New England coast. At the close of the month this disturbance was apparently

central in the northern portion of New England, but the barometric pressure at the centre had increased from 29.11 to 29.44 within twenty-four hours.

The following notes, as to this storm, are of interest:

Columbus, Ohio: on the 28th heavy rain fell from 3 to 9 a. m., with thunder-storm from 5 to 6.10 a. m. At 11.55 a. m. a westerly gale set in, it suddenly increased in velocity at 1.25 p. m. and blew at the rate of forty-six miles per hour; the rainfall was very heavy. The gale continued, with occasional gusts of high velocity, until 7 p. m. Property in the city was damaged to the extent of \$2,000. At Cincinnati the wind blew from the northwest at the rate of forty-eight miles per hour, and was accompanied by heavy rain. The rainfall was heavy at Louisville, Ky.; highest velocity of wind forty miles.

Pittsburg, Pa.: on the 28th rain fell from 7.50 a. m. until 6.30 p. m., and heavily from 10.30 to 11.30 p. m. For a few minutes after 11 p. m. hail fell. Brisk southwesterly winds prevailed, reaching a velocity of thirty miles per hour at 11.15 p. m. The pressure at 3 p. m. stood at 29.27, this was the lowest reading since January 9, 1886. The total rainfall of the twenty-four hours ending 7 a. m. of the 29th was 2.56 inches.

Lynchburg, Va.: on the 28th the barometer fell rapidly until 3 p. m. when it stood at 29.40; southerly shifting to brisk northwest winds. Between 3 and 4 p. m. a thunder-storm moving from west to east, and accompanied for a few minutes by hail, occurred. During the afternoon the wind attained for a few minutes the velocity of thirty-six miles per hour. In Amherst county the storm exhibited unusual violence and the rain was heavy. Near Riverville a

tobacco house was blown down and one person killed. Reports from a number of places in the state show that the storm was widespread and severe.

Variety Mills, Nelson Co., Va.: the storm accompanying the depression of the 28th was very destructive in this vicinity. At 3 p. m. a heavy mass of clouds approached from the northwest and rain began falling heavily, accompanied between 3.30 and 4 p. m. by hail. Shortly after the rain began falling a gale set in, unroofing several buildings and prostrating trees.

Hatteras, N. C.: on the morning of the 28th high west and southwest winds prevailed. During the afternoon a heavy thunder-storm with high wind occurred, maximum velocity forty-nine miles per hour. The wind continued high on the 29th; maximum velocity, forty miles per hour, from the west.

XIII.—The complete history of this storm will be found in the REVIEW for the succeeding month. It was central north of Montana on the 29th and passed almost directly southward to northern Nebraska, where it was central at the close of the month, the general form of the depression being elliptical and extending from Colorado to northern Minnesota, and the lowest isobar being 29.3. The barometric gradient was greatest to the westward, the pressure increasing quite regularly to the north Pacific coast, where it had reached 30.4, showing a barometric range of 1.23 inches between the upper Missouri valley and eastern Oregon.

NORTH ATLANTIC STORMS DURING APRIL, 1887.

[Pressure in inches and millimetres; wind-force by Beaufort scale.]

The paths of the depressions that have appeared over the north Atlantic Ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ships' logs and other data collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports received through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the proprietors of the "New York Maritime Register," and from other miscellaneous data received at this office up to May 21, 1887.

Eleven depressions are traced over the ocean and the Canadian Maritime Provinces, the tracks largely predominating, as in March, 1887, to the southward and southeastward of Nova Scotia and Newfoundland. Four storms passed northeast from Nova Scotia; three moved eastward to the south and southeast margin of the ice region, where they remained nearly stationary as areas of low pressure during periods of from two to nine days. Two depressions appeared in European waters and apparently passed south of east over the continent; one is first charted over mid-ocean, and one moved westward north of the Azores and united with an area of low pressure off the southeast edge of the Banks of Newfoundland. But one depression is traced from American waters to the European coast.

The general character of the weather over the north Atlantic Ocean was unusually severe during a greater portion of the first two decades of the month. From the 1st to the 5th, inclusive, gales of hurricane force were encountered off the coast of the United States. From the 12th to the 16th, inclusive, gales of exceptional violence prevailed over, and to the eastward of, the Banks of Newfoundland. During the last decade of the month the weather conditions in the trans-Atlantic routes were more settled, although strong gales were experienced over the western portion of the ocean from the 26th to the 29th. The depressions attained greatest force west of the thirty-fifth meridian, which fact may be attributed to the high temperatures reported in the waters of the Gulf Stream in the vicinity, and somewhat to the northward of, the thirty-fifth parallel, whereby the storms which passed over its surface acquired material for the development of great energy. Barometric pressure was high over, and to the eastward of, the Banks of Newfoundland until the 3d, when a depression advancing from the southwest caused a decided fall in the barometer over the Banks and Maritime Provinces. On the 4th a rapid decrease in pressure over the ocean northwest of the

British Isles indicated the presence of a storm-area which apparently passed eastward over Scotland into the North Sea by the 5th. The barometric pressure over mid-ocean fluctuated until the 12th, after which it continued generally low until the 26th, attending the presence to the westward of areas of low pressure. During the last four days of the month the barometer was high over mid-ocean and slowly rising in the vicinity of the British Isles.

For April, 1886, thirteen depressions were traced, of which, one was the continuation of an area of low pressure traced on the North American continent; one was traced on the coast of Ireland; one originated northeast of the Bahamas; one appeared in the Gulf of Saint Lawrence; one developed near Charleston, S. C., and the remaining depressions first appeared over the ocean east of the fiftieth meridian, between the thirty-seventh and fiftieth parallels. The direction of movement of the depressions was greatly diversified, and their positions extended from N. 37° to 55°, and from W. 50° to the European coast. An additional noteworthy characteristic of the storms of that month was their exceeding slow rate of progression.

As compared with the corresponding month of previous years, the number of depressions which appeared during April, 1887, was somewhat less than the average for the month, while their direction of movement and position did not differ materially. A noticeable and unusual feature was the continuation, during a greater portion of the month, of severe disturbances to the eastward and southward of the Banks of Newfoundland.

The following are brief descriptions of the depressions traced:

1.—This depression was central in about N. 38°, W. 13° on the 1st, with central pressure ranging below 29.60 (751.8), whence it apparently moved eastward to the Mediterranean Sea.

2.—This depression was a continuation of land-area number xi traced for March, 1887, which passed off the coast of the United States in about N. 35° during the evening of March 31st. On the morning of April 1st the storm was central in N. 37°, W. 72°, with fresh to strong gales over a limited area. By the 2d the centre of depression had advanced northeast to N. 40°, W. 69°, with central pressure about 29.30 (744.2) and an appreciable increase in energy. By the 3d the storm-centre had passed northeast to the south coast of Nova Scotia, accompanied by gales of great violence and very low barometric pressure. From this position the depression moved northeastward over Newfoundland beyond the region of observation.

The following special reports refer to disturbances accompanying the passage of this depression:

Capt. Charles Brown, of the bkt. "Josephine," reports a nw. gale of hurricane force on the 1st, in N. $31^{\circ} 11'$, W. $75^{\circ} 0'$, at noon; previous to gale (which commenced at 19 hours) the wind had veered from sse. to sw., with falling barometer. Capt. J. H. Taat, of the s. s. "Edam," reports a storm on the 2d; wind veered from se. to wnw.; lowest barometer, 29.17 (740.9), at 4 a. m., in N. $41^{\circ} 33'$, W. $61^{\circ} 12'$. Capt. C. E. Durkee, of the ship "Mable Taylor," reports a heavy ne. backing to nw. gale on the 2d, in N. $37^{\circ} 12'$, W. $73^{\circ} 10'$, at noon, with very heavy ne. and nw. cross sea. Capt. J. S. Garvin, of the s. s. "Orinoco," reports a strong s. veering to sw. gale on the 2d, in N. $36^{\circ} 25'$, W. $67^{\circ} 34'$, at noon, with rain and heavy sea; barometer 29.12 (739.6), rising rapidly in p. m.

Capt. J. P. Stowers, of the brig "L. Staples," was in the centre of a cyclonic area at 8.30 p. m.; position at noon, N. $38^{\circ} 17'$, W. $69^{\circ} 40'$. Wind then came from nw. with almost hurricane force, accompanied by fearful sea and hail and rain-squalls. Third Officer J. H. Mills, of the s. s. "Aurania," Capt. W. H. P. Haines, commanding, reports a gale of force 12, veering from sse. to w., on the 2d; lowest barometer, 29.06 (738.1), at midnight, in N. $40^{\circ} 42'$, W. $65^{\circ} 18'$. Capt. Thomas Craig, of the s. s. "Italia," reports a whole se. to nw. gale on the 2d; lowest barometer, 29.59 (751.6), at 8 p. m., in N. $36^{\circ} 44'$, W. $63^{\circ} 15'$. Capt. R. Potter, of the s. s. "Santiago," reports a strong gale on the 3d; wind veered from s. to wnw.; lowest barometer, 29.59 (751.6), at 8 a. m., in N. $40^{\circ} 30'$, W. $54^{\circ} 40'$.

3.—This depression is charted in N. 54° , W. 25° , under date of the 6th, whence it passed southeast and apparently united with an area of low pressure which appeared off the northeast coast of Spain on the 7th. The depression was relatively shallow and was unaccompanied by noteworthy features.

4.—This depression was a continuation of land-area number iii which passed northeast over Nova Scotia during the 6th. By the 7th the centre of depression had moved northeast to the northern extremity of Newfoundland, whence it disappeared beyond the region of observation. The depression was of slight depth, but occasioned gales of considerable strength, as is shown by the following reports:

Capt. W. Dalziel, of the s. s. "Manitoba," reports a heavy ssw. to w. gale during the night of the 5-6th; lowest barometer, 29.80 (756.9), at midnight, in N. $40^{\circ} 50'$, W. $63^{\circ} 54'$. Capt. Thomas Craig, of the s. s. "Italia," reports a strong gale, attaining greatest force on the 5th, in N. $39^{\circ} 6'$, W. $68^{\circ} 25'$; wind veered from s. to nw.; lowest barometer, 29.71 (754.6), at 10 p. m.

5.—This depression appeared off the northwest coast of Spain on the 7th and moved slowly west to N. 44° , W. 16° by the 8th. By the 9th the storm-centre had passed southwest to N. 42° , W. 22° , whence it circled north of west and united with depression number 6 on the 11th. This well-defined storm possessed slight depth and exhibited small energy.

6.—This depression apparently originated over the ocean to the southeast of Nova Scotia and moved eastward to N. 40° , W. 49° by the 9th. During the next nine days the depression circled in a diversified course over the ocean to the southeast and east of the Banks of Newfoundland. During this period the pressure gradually decreased within the storm-area until the 15th, when readings ranging below 28.50 (723.9) were shown. Subsequent to the 15th there was a decided increase in barometric pressure. From the 18th to the 21st, inclusive, the depression is traced from N. 50° , W. 40° to the north of Ireland, a marked loss of strength being shown after the storm-area passed to the eastward of the thirty-fifth meridian.

The following special reports show the exceptional violence of the disturbances encountered within the area of this depression over the western portion of the ocean:

Capt. H. McKay, of the s. s. "Servia," reports a gale which veered from se. to w. at 8.40 p. m. of the 13th, in N. $46^{\circ} 18'$, W. $39^{\circ} 55'$, at which time the barometer stood 29.02 (737.1). Capt. W. R. Lord, of the s. s. "Critic," reports a hurricane on the 14th; wind veered from s. to n.; lowest barometer,

29.23 (742.4), at noon, in N. $42^{\circ} 36'$, W. $54^{\circ} 41'$. Capt. E. Parry, of the s. s. "Bulgarian," reports a whole nw. gale attaining greatest force on the 13th, at 10.30 p. m., in N. $42^{\circ} 48'$, W. $54^{\circ} 30'$, when barometer read 28.95 (735.3). Advicees from Saint John's, Newfoundland, stated that considerable loss of life and property resulted from the gale of the 12-13th. Capt. A. Kuhn, of the s. s. "Polynesia," reports a storm attaining force 11 on the 14th, in N. $40^{\circ} 50'$, W. $55^{\circ} 30'$. The s. s. "Servia" encountered a gale from se. backing to nne., at 8.10 p. m. of the 14th, in N. $43^{\circ} 11'$, W. $47^{\circ} 20'$, when barometer read 28.92 (734.6). Capt. W. Rea, of the s. s. "Bas-sano," reports a strong s. to nw. gale from the 13th to 15th; lowest barometer, 28.73 (729.7), at 8 a. m. of the 14th, in N. $39^{\circ} 40'$, W. $49^{\circ} 10'$. Capt. W. A. Griffiths, of the s. s. "Spain," reports a strong westerly gale on the 14th; lowest barometer, 28.29 (718.6), at 7 p. m., in N. $41^{\circ} 28'$, W. $46^{\circ} 10'$. Capt. D. Pert, of the s. s. "Alexandria," reports a s. to w. hurricane on the 14th; lowest barometer, 28.75 (730.2), at midnight, in N. $40^{\circ} 28'$, W. $39^{\circ} 20'$. Capt. C. N. Mumford, of the s. s. "Earn-well," reports a strong nw. gale on the 13th and 14th; lowest barometer, 29.10 (739.1), at 4 a. m. of the 14th, in N. $36^{\circ} 22'$, W. $54^{\circ} 58'$. Capt. A. D. Hadley, of the s. s. "France," reports a storm from the 13th to 15th; wind veered from se. to sw.; lowest barometer, 28.48 (723.4), at 4 a. m. of the 15th, in N. $42^{\circ} 48'$, W. $40^{\circ} 13'$. Commodore W. G. Randle, commanding the s. s. "Westernland," reports a s. to wsw. gale during the 14th and 15th; lowest barometer, 28.47 (723.1), at 8 a. m. of the 15th, in N. $43^{\circ} 22'$, W. $40^{\circ} 44'$. Capt. John McKeague, of the s. s. "Dorian," reports a gale on the 14th and 15th; wind veered from se. to wnw.; lowest barometer 28.30 (718.8); barometer rose during the 15th; position at noon (Greenwich mean time) of the 14th, N. $41^{\circ} 50'$, W. $44^{\circ} 40'$; at noon of the 15th, N. $42^{\circ} 33'$, W. $42^{\circ} 0'$. Mr. J. Higgins, observer at Saint John's, Newfoundland, reports: "On the 15th the wind was ne. blowing brisk, with light rain; at 9 p. m. the wind attained force of strong gale and continued till early next morning."

7.—This depression advanced northeast over the northern extremity of Newfoundland during the morning of the 12th, and, while possessing considerable depth, passed too far to the northward of the region of observation to be severely felt in the trans-Atlantic track.

8.—This depression was a continuation of land area number viii which left the coast of the United States in about N. 40° during the early morning of the 16th. By the 17th the centre of depression had advanced eastward over the ocean to the south of Nova Scotia, with central pressure about 29.30 (744.2), whence it passed eastward to the fifty-first meridian by the 18th, with a slight increase in barometric pressure. By the 19th the storm-centre had shifted slightly to the northeastward, after which it dissipated. No special reports have been received relative to the disturbances accompanying this depression, which were apparently of small force.

9.—This depression was a continuation of land area number ix which passed off the coast in about N. 37° during the evening of the 18th. By the 19th the centre of depression had advanced to the southward of Nova Scotia, where pressure ranging below 29.40 (746.7) was shown. During the next two days the storm-centre moved slowly eastward to the south of Newfoundland, without evidence of marked energy; it then circled southeast to the fortieth parallel, where it remained, with slight changes in position, until the 25th, after which it filled up. The depression was relatively shallow throughout its course, and was unaccompanied by noteworthy features.

10.—This depression appeared in N. 57° , W. 14° on the 22d, and passed southeast over Ireland by the 23d, with barometric pressure below 29.00 (736.6), after which it apparently moved northeast over Scotland beyond the region of observation. The depression was accompanied by fresh to strong gales over the ocean to the twenty-fifth meridian, relative to which the following report has been made:

Capt. J. B. Watt, of the s. s. "Samaria," reports a strong

nw. gale on the 22d; lowest barometer, 29.48 (748.8), at 4 p. m., in N. 51° 0', W. 16° 50'.

11.—This depression was a continuation of land area number xi which advanced from the Gulf of Mexico along the east coast of the United States to the Gulf of Saint Lawrence during the 25th and 26th. During the 27th the centre of depression passed northeast over the west portion of Newfoundland, beyond the region of observation. The depression gathered energy during its passage along the coast, and occasioned strong gales in the vicinity of the fortieth parallel on the 26th, as is shown by the following reports:

Capt. W. Stamper, of the s. s. "Worcester," reports a strong gale on the 26th and 27th; wind veered from e. to w.; lowest barometer, 29.58 (751.3), at 8 a. m. of the 26th, in N. 41° 0', W. 63° 30'. Capt. D. W. Storer, of the brig "Abbie Clifford," reports a strong gale on the 26th; wind veered from e. to sw.; lowest barometer 29.60 (751.8); position at noon, N. 36° 10', W. 73° 45'. Capt. C. Thomas, of the s. s. "Monte Rosa," reports a gale on the 25th and 26th; wind veered from e. to wsw. and blew hardest from wsw., with heavy cross sea; position at noon of the 25th, N. 42° 0', W. 59° 0'.

OCEAN ICE.

During April, 1887, icebergs and field ice were reported as follows:

Date.	Vessels.	Position.		Remarks.
		Lat. N.	Lon. W.	
1	S. S. Werra	42 52	48 19	One iceberg.
2	S. S. Palestine	43 00	49 00	Two small bergs.
	S. S. Werra	42 20	49 50	One berg and several pieces.
	S. S. Austrian	43 00	48 11	One berg.
3	S. S. Venetian	45 00	38 18	A piece of ice.
4	S. S. British Queen	44 16	49 08	Two icebergs.
	S. S. Austrian	Off Cape Race		Several large bergs.
	S. S. Ludgate Hill	43 04	49 56	One very large berg.
	S. S. Baltic	40 47	49 20	Two pieces of ice.
5	do	42 47	49 20	Two large bergs.
	S. S. Adriatic	43 04	49 20	Four icebergs and two floes.
	S. S. Hungary	42 29	49 50	
	S. S. Montauk	42 14	49 22	Small bergs.
	S. S. Ems	42 00	49 55	Three small bergs.
	S. S. Ems	43 30	49 35	Field ice.
	S. S. Hungarian	43 55	49 02	
6	S. S. Hungarian	42 14	49 22	Icebergs.
	S. S. Suevia	42 10	49 55	Small pieces of ice.
7	S. S. Umbria	42 44	49 23	One iceberg.
	S. S. Austrian	42 25	48 33	Two large bergs.
8	do	Off Ferryland Head		Several large bergs.
	S. S. Siberian	44 56	55 30	One large berg.
	S. S. Arabic	42 28	48 28	One small berg.
	S. S. Rotterdam	43 34	49 53	Do.
	S. S. Rotterdam	42 28	48 28	Do.
	S. S. Circassian	43 21	50 27	Do.
10	S. S. Mentmore	41 10	50 00	Three large bergs.
	S. S. Rotterdam	41 55	49 23	Passed n. of two large bergs.
12	S. S. Bulgarian	43 04	49 27	Two bergs.
	S. S. Trave	43 03	50 19	One small berg.
14	S. S. Wetherby	42 07	49 46	One large berg.
	Bk. Maury	42 02	48 20	Three small bergs.
16	S. S. Portia	45 30	48 00	Heavy ice field; cleared it 15 miles n. of Sable Island.
	Bk. Maury	43 00	50 00	Large bergs and field ice.
17	S. S. State of Nevada	40 02	50 04	One small berg.
18, 20, 21	S. S. Glueckauf	42 02	49 54	One berg.
	S. S. Zaandam	41 28	47 49	Ice at sea off Saint John's, N. F.
	S. S. Nova Scotian	48 09	51 05	One berg.
20	S. S. Straits of Gibraltar	42 30	46 50	One small berg.
	S. S. Nova Scotian			Pieces of field ice.
21	S. S. La Bretagne	43 36	47 34	Large quantities of heavy ice in Saint John's entrance.
	S. S. Newfoundland			Three small bergs.
	S. S. St. Pierre			Ice on Mislane bank, s. of Liscomb, and packed ice off Witchaven.
22	S. S. Ashburne	43 40	46 40	Heavy field ice.
23	S. S. Highland Prince	46 27	49 03	One large berg.
	S. S. Nova Scotian			Three large icebergs.
	S. S. Lufra	Between Cape Spear and Cape Race		Several large bergs.
	S. S. Lufra	80 miles s. of Virgin Rocks		Do.
25	S. S. Nova Scotian	44 08	61 47	Field ice.
28	S. S. Samaria	42 40	50 01	One moderate sized berg.
	S. S. Herrmann	42 00	49 00	Several bergs.
	S. S. Samaria	42 00	51 00	
29	S. S. Samaria	42 23	50 07	One large berg.
	S. S. Oregon	46 27	54 28	One berg.
	S. S. Hibernian	42 20	50 18	One small berg.
	S. S. Werra	42 20	50 28	One large berg.
30	S. S. De Ruyter	43 37	48 00	One iceberg.

On chart i are also exhibited the limits within which icebergs and field ice were reported during April, 1887. These

limits are determined from reports furnished by shipmasters, and from data collected by the Signal Service agencies.

The easternmost ice was passed on the 3d, in N. 48° 00', W. 38° 18', by the s. s. "Venetian," and the southernmost ice reported was observed on the 17th, in N. 40° 02', W. 50° 04', from the s. s. "State of Nevada."

Ice was most frequently encountered during the month on the southern edge of the Banks of Newfoundland in the vicinity of the fiftieth meridian. Large icebergs and field ice were reported, at intervals, off the east and southeast coasts of Newfoundland, and from the 16th to the 25th heavy field ice was observed from Cape Breton to Sable Island.

As compared with ice reported during March, 1887, there has been an increase in the quantity encountered off the Newfoundland coast and in the vicinity of Cape Breton and Sable Island, while over the Banks of Newfoundland and in the trans-Atlantic routes there was a deficiency.

As compared with April, 1886, the eastern limit is about eight degrees further west, and the southern limit nearly one degree further south.

As compared with the corresponding month of previous years, the ice reported by trans-Atlantic steamers was somewhat deficient, which fact is attributed to vessels more nearly following the southerly and safer route. Reports show that the water temperature in the trans-Atlantic route increased but slightly, as compared with March, which would indicate but a small diminution in the southward trend of the ice-fields.

The following table shows the southern and eastern limits of the region within which ice was reported for April during the last six years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Lon. W.	Month.	Lat. N.	Lon. W.
April, 1883	40 49	52 05	April, 1883	48 00	43 00
April, 1884	41 26	48 46	April, 1884	45 23	43 34
April, 1885	41 40	49 50	April, 1885	44 10	39 41
April, 1886	40 51	45 39	April, 1886	47 43	30 11
April, 1887	40 02	50 04	April, 1887	48 00	38 18

FOG.

The following table shows the limits of fog-areas on the north Atlantic Ocean during April, 1887, as reported by shipmasters:

Date.	Vessel.	Entered.			Cleared.		
		Lat. N.	Lon. W.	Time.	Lat. N.	Lon. W.	Time.
6	S. S. Ems	43 16	51 13		42 58	53 22	
6	S. S. Rotterdam	40 28	70 46		40 28	69 36	
6	do	40 28	69 18		40 28	69 00	
7	S. S. Sueva	42 42	49 53	2 a. m.	42 41	50 07	3 a. m.
12	S. S. Britannic	44 22	48 23		42 50	51 37	
12	S. S. Rhaetia	41 50	46 25		41 40	46 45	
12	S. S. Trave	42 30	47 09		42 17	48 19	
16	S. S. Rhaetia	40 35	67 50		40 35	68 00	
18-19	S. S. Geiser	59 14	4 05	11 p. m.	57 32	15 58	9 a. m.
18	S. S. Sueva	41 56	50 14	4 p. m.	42 38	47 00	
18	S. S. Borderer	41 10	62 17		41 16	60 55	
19-20	S. S. Gothia	42 50	48 50		42 30	51 40	
19	S. S. St. Ronans	40 45	62 06		40 42	64 05	
19	S. S. Norseman	42 23	64 58	7.20 a. m.	42 23	65 30	10 a. m.
19	S. S. Bothnia	42 20	48 00	1.30 a. m.	42 00	50 00	1.50 p. m.
19	S. S. Zaandam	41 20	48 25		41 00	50 40	
19	S. S. Borderer	41 44	53 20		42 57	46 07	
20	S. S. Devonian	42 05	50 20		42 20	47 44	
20	S. S. Saale	41 53	47 02	8 p. m.	41 30	48 45	3.30 a. m.
19-20	S. S. Celtic	44 46	46 31	6 a. m.	43 23	51 52	4 a. m.
21	S. S. La Bretagne	43 05	48 35		42 45	50 00	
19-25	Dense fog prevailed at Saint John's, N. F.						
22-24	S. S. Britannic	41 51	54 11		42 51	48 50	
23-24	S. S. Gothia	40 40	70 30		40 36	71 20	
24	S. S. California	42 09	51 26		41 50	54 55	
25	S. S. Martello	41 25	49 00	2.30 a. m.	41 30	52 40	11 p. m.
25	S. S. Geiser	41 48	46 08	10.30 p. m.	40 41	49 09	8.30 p. m.
25-26	S. S. Cephalonia	41 49	61 00	7.30 a. m.	41 50	62 00	10.15 a. m.
29	S. S. Geiser	41 05	66 44	8 a. m.	41 06	67 53	1.30 p. m.
30	S. S. Waesland	42 59	41 41		42 51	42 02	

Fog was most frequently encountered during the month along the southern edge of the ice-fields which extended to the southward of the Banks of Newfoundland, and the meteorological

conditions attending its formation were identical with those noted for the preceding month, *i. e.*, the intermingling of warm, humid air from the ocean to the southward, or from over the Gulf Stream, and the chilled air attending the ice-fields; the former being drawn to this locality by the cyclonic movement

of the atmosphere within the eastern or southern quadrants of areas of low barometric pressure. Of the eleven dates for which dense fog was reported in this locality, nine show the presence of the centres of areas of low pressure to the westward and two to the northwestward of the fog banks.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for April, 1887, is exhibited on chart ii by the dotted isothermal lines. In the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service, and in the figures above the geographical districts, the average temperature and departure for each district. The normal for any district may be found by adding the departure to the current mean for the district when the departure is below the normal, and subtracting when above. On chart iv the departures from the normal are illustrated by lines connecting stations of normal or equal abnormal values.

The mean temperature of the month is very nearly normal in all districts; the greatest departures occur in the central Mississippi and lower Missouri valleys, where the temperature has been, at different stations, from 2° 0 to 5° 9 warmer than the average April. In the west Gulf states and Texas it has been about 1° 0 above the normal; over the lower lake region, Canada, New England, and along the Atlantic coast it has been slightly below the normal, the average departure being 1° 5 and the greatest 3° 8 at Albany, N. Y. In the northern and middle Pacific coast regions the temperature of the month has been 0° 5 to 2° 4 below the normal, except at Sacramento, Cal., where the departure is 1° 3 above. On the 2d very low temperatures, for the season, prevailed over the south Atlantic states, east Gulf states, and Florida, producing in some sections light frosts. In the Lake region the minimum temperature of the month occurred at all stations on the 5th. The high temperatures of the 13th in the Ohio and central Mississippi valleys are noteworthy features of the meteorology of the month.

The following are some of the most marked departures from the normal temperature at Signal Service stations:

Above normal.		Below normal.	
Yankton, Dak.....	5.9	Albany, N. Y.....	3.8
Saint Louis, Mo.....	4.7	Mount Washington, N. H.....	3.0
Omaha, Nebr.....	4.5	Norfolk, Va.....	3.0
Fort Smith, Ark.....	3.6	Portland, Me.....	2.8
Fort Buford, Dak.....	3.3	Cedar Keys, Fla.....	2.7
Leavenworth, Kans.....	3.3	Key West, Fla.....	2.7
Bismarck, Dak.....	2.8	Lynchburg, Va.....	2.5

DEVIATIONS FROM NORMAL TEMPERATURES.

In the table below are given, for certain stations, as reported by voluntary observers, the normal temperatures of April for a series of years, the mean temperature for April, 1887, and the departures from the normal:

Station.	County.	Normal temperature for April.	Number of years.	Mean temperature for April, 1887.	Departure.
<i>Arkansas.</i>					
Lead Hill.....	Boone.....	60.7	5	63.9	+ 3.2
<i>California.</i>					
Sacramento.....	Sacramento.....	59.2	21	57.3	- 1.9
<i>Connecticut.</i>					
Middletown.....	Middlesex.....	45.4	29	44.3	- 1.1
New Haven.....	New Haven.....	46.8	101	44.4	- 2.4
Waterbury.....	New Haven.....	46.6	12	43.0	- 3.6
<i>Dakota.</i>					
Webster.....	Day.....	44.8	4	45.3	+ 0.5
<i>Florida.</i>					
Archer.....	Alachua.....	65.8	4	62.2	- 3.6
<i>Illinois.</i>					
Collinsville.....	Madison.....	57.3	8	55.9	+ 4.7
Mattoon.....	Coles.....	51.6	7	53.0	+ 1.4
Peoria.....	Peoria.....	52.2	31	57.3	+ 5.1
Sycamore.....	De Kalb.....	46.5	6	48.2	+ 1.7

Deviations from normal temperatures—Continued.

Station.	County.	Normal temperature for April.	Number of years.	Mean temperature for April, 1887.	Departure.
<i>Indiana.</i>					
Lafayette.....	Tippecanoe.....	50.0	8	50.6	+ 0.6
Logansport.....	Cass.....	53.2	33	53.1	- 0.1
Vevay.....	Switzerland.....	54.8	21	53.9	- 0.9
<i>Iowa.</i>					
Cresco.....	Howard.....	43.9	10	46.3	+ 2.4
Monticello.....	Jones.....	48.1	34	49.0	+ 1.5
Muscataine.....	Muscataine.....	48.5	49	50.8	+ 2.3
<i>Kansas.</i>					
Independence.....	Montgomery.....	57.1	16	59.8	+ 2.7
Wellington.....	Sumner.....	55.6	9	58.1	+ 2.5
<i>Louisiana.</i>					
Grand Coteau.....	Saint Landry.....	67.1	5	69.1	+ 2.0
<i>Maine.</i>					
Belfast.....	Waldo.....	43.6	26	39.1	- 4.5
Cornish.....	York.....	41.8	30	38.9	- 2.9
Orono.....	Penobscot.....	39.9	19	37.3	- 2.6
<i>Maryland.</i>					
Cumberland.....	Alleghany.....	51.5	15	49.2	- 2.3
Fallston.....	Harford.....	49.7	16	47.5	- 2.2
<i>Massachusetts.</i>					
Amherst.....	Hampshire.....	45.2	50	44.9	- 0.3
Cambridge.....	Middlesex.....	44.2	65	43.3	- 0.9
Fitchburg.....	Worcester.....	42.4	51	40.7	- 1.7
New Bedford.....	Bristol.....	44.5	75	43.1	- 1.4
Somerset.....	Bristol.....	45.4	17	45.3	- 0.1
Springfield.....	Hampden.....	46.0	20	45.2	- 0.8
Taunton.....	Bristol.....	46.5	16	43.6	- 2.9
Williamstown.....	Berkshire.....	41.9	33	39.5	- 2.4
<i>Nebraska.</i>					
Carson City.....	Ormsby.....	47.8	8	48.1	+ 0.3
<i>New Brunswick.</i>					
Saint John.....	Saint John.....	37.4	27	37.0	- 0.4
<i>New Hampshire.</i>					
Concord.....	Merrimack.....	44.6	19	43.4	- 1.2
Hanover.....	Grafton.....	41.3	27	36.6	- 4.7
<i>New Jersey.</i>					
Dover.....	Morris.....	43.7	5	44.5	+ 0.8
South Orange.....	Essex.....	48.3	17	46.8	- 1.5
<i>New York.</i>					
Factoryville.....	Tioga.....	43.5	5	42.9	- 0.6
North Volney.....	Oswego.....	41.3	20	40.6	- 0.7
Palermo.....	Oswego.....	42.5	33	38.9	- 3.6
<i>Ohio.</i>					
Wauseon.....	Fulton.....	46.4	17	46.2	- 0.2
<i>Pennsylvania.</i>					
Wilkesbarre.....	Luzerne.....	48.2	9	44.9	- 3.3
<i>South Carolina.</i>					
Stateburg.....	Sumter.....	62.0	7	61.4	- 0.6
<i>Texas.</i>					
New Ulm.....	Austin.....	68.3	15	68.9	+ 0.6
<i>Vermont.</i>					
Lunenburg.....	Essex.....	37.9	38	35.9	- 2.0
Newport.....	Orleans.....	39.7	13	36.2	- 3.5
Stratford.....	Orange.....	40.8	13	37.6	- 3.2
<i>Virginia.</i>					
Bird's Nest.....	Northampton.....	54.8	16	52.7	- 2.1
Dale Enterprise.....	Rockingham.....	51.7	7	54.3	+ 2.6
Variety Mills.....	Nelson.....	54.1	10	51.2	- 2.9
Wytheville.....	Wythe.....	52.1	23	52.0	- 0.1
<i>West Virginia.</i>					
Helvetia.....	Randolph.....	48.5	11	47.7	- 0.8

* From the "Bulletin of the New England Meteorological Society."

The following notes on temperature are from the reports of voluntary observers:

Illinois.—Mattoon, Coles Co.: during the past eight years the warmest April occurred in 1880, mean temperature, 58° 0; the coldest in 1881 and 1885, mean, 47° 0. [The observer states that all temperature records at this station previous to April, 1887, are 2° 0 too high for readings between 26° and 39°, and 3° 0 too high from 50° to 80°.]

Indiana.—Logansport, Cass Co.: in the past thirty-three years the extreme April temperatures are 99° 0, in 1870, and 8° 0, in 1865.

Iowa.—Monticello, Jones Co.: during the past thirty-four years the extreme April temperatures are 94° 0, in 1855, and 12° 0, in 1874; the highest and lowest April means are 56° 0, in 1855, and 38° 0, in 1857.

Kansas.—Wellington, Sumner Co.: during the past nine years the warmest April occurred in 1880, mean temperature, 59° 6; the coldest in 1884, mean, 50° 7; the extremes of April in that time are 95° 0, in 1887, and 15° 0, in 1881.

Maryland.—Cumberland, Alleghany Co.: the temperature of April in the past fifteen years is shown in the following table:

Year.	Highest.	Lowest.	Mean.	Year.	Highest.	Lowest.	Mean.
1873.....	82.0	35.0	57.0	1882.....	79.0	26.0	50.5
1874.....	66.0	24.0	45.0	1883.....	72.0	28.0	48.0
1875.....	67.0	24.0	47.0	1884.....	75.0	30.0	49.5
1876.....	80.0	32.0	49.0	1885.....	80.0	26.0	50.2
1877.....	76.0	32.0	57.0	1886.....	80.0	33.0	55.0
1878.....	80.0	34.0	55.0	1887.....	82.0	26.0	49.2
1879.....	80.0	23.0	50.0				
1880.....	82.0	24.0	53.0	Average.....	77.4	28.2	51.5
1881.....	80.0	24.0	57.6				

Massachusetts.—Worcester, Worcester Co.: the temperature of April, 1887, was a few degrees below the mean for the past fifty years. The extremes of April temperature for the past half century are 12° and 86°, the mean, 44° 3.

New York.—Palermo, Oswego Co.: the highest April mean temperature of the past thirty-three years, 50° 0, occurred in 1878; the lowest, 32° 4, in 1874.

South Carolina.—Stateburg, Sumter Co.: the extreme April temperatures during the past seven years both occurred in the current month, highest, 87° 0, on the 12th, lowest, 29° 5, on the 2d; the highest mean temperature, 64° 6, occurred in 1882; the lowest mean, 60° 1, in 1884.

Vermont.—Strafford, Orange Co.: during the past thirteen years the warmest April was in 1886, mean temperature, 48° 3; the coldest in 1875, mean, 35° 7.

Virginia.—Dale Enterprise, Rockingham Co.: in the past seven years the highest April mean temperature, 59° 1, occurred in 1886; the lowest mean, 42° 4, in 1883.

RANGES OF TEMPERATURE.

The monthly, and the greatest and least daily, ranges of temperature, are given in the table of miscellaneous meteorological data.

The following are some of the greatest and least monthly ranges at Signal Service stations:

Greatest.		Least.	
Saint Vincent, Minn.....	87.1	Tatoosh Island, Wash.....	18.5
Fort Totten, Dak.....	83.2	Key West, Fla.....	22.8
Moorhead, Minn.....	82.3	Port Angeles, Wash.....	25.6
Huron, Dak.....	78.3	Astoria, Oregon.....	26.4
Fort Yates, Dak.....	77.2	Eureka, Cal.....	28.2
Fort Buford, Dak.....	76.2	Galveston, Tex.....	30.2

FROSTS.

Frosts occurred in the states and territories, as follows:

Alabama.—Livingston, 1st, 6th; Montgomery, 6th.

Arizona.—1st, 9th to 20th, 22d to 26th.

Arkansas.—Lead Hill and Fort Smith, 1st, 5th, 24th; Little Rock, 5th, 24th.

California.—Keeler, 8th, 12th; Oroville, 11th; San Francisco, 11th, 12th; Fort Bidwell, 18th; Eureka, 21st; Sacramento, 30th.

Colorado.—1st to 4th, 11th to 26th.

Connecticut.—3d, 6th to 9th, 14th, 18th.

Dakota.—1st, 3d to 7th, 10th, 11th, 13th to 26th.

District of Columbia.—7th, 14th, 20th, 21st.

Florida.—Jacksonville, 2d.

Georgia.—Savannah, Augusta, and Quitman, 2d; Atlanta, 2d, 5th; Athens, Milledgeville, and Forsyth, 2d, 6th.

Idaho.—3d, 12th, 18th, 19th, 22d, 24th, 25th.

Illinois.—1st to 8th, 16th, 18th, 19th, 21st to 27th.

Indiana.—1st, 2d, 5th to 9th, 19th, 21st, 24th, 26th, 30th.

Indian Territory.—Fort Sill, 23d.

Iowa.—1st to 8th, 16th to 19th, 21st to 27th, 29th.

Kansas.—1st, 3d, 4th, 5th, 15th to 20th, 22d to 25th.

Kentucky.—1st, 2d, 5th, 6th, 8th, 18th, 19th, 22d, 24th, 30th.

Louisiana.—Liberty Hill, 1st, 5th; Shreveport, 5th.

Maine.—2d, 25th.

Maryland.—6th to 9th, 19th, 20th, 25th.

Massachusetts.—1st, 2d, 3d, 5th to 9th, 13th, 14th, 15th, 18th, 19th, 21st, 22d, 25th.

Michigan.—1st, 2d, 4th to 9th, 11th, 12th, 13th, 15th to 27th, 29th, 30th.

Minnesota.—3d to 11th, 16th to 21st, 23d to 26th.

Missouri.—Springfield, 4th, 5th, 18th, 23d, 24th; Central College, 24th, 25th.

Montana.—1st, 3d, 4th, 5th, 12th to 20th, 22d to 26th.

Table of comparative maximum and minimum temperatures for April.

State or Territory.	Station.	For 1887.		Since establishment of station.		
		Max.	Min.	Max.	Year.	Min. Year.
Alabama.....	Mobile.....	85.8	41.0	90.0	1881, 1883	32.0 1881
Do.....	Montgomery.....	87.1	39.7	90.0	1880	30.0 1881
Arizona.....	Prescott.....	78.6	23.0	86.0	1879	13.0 1878
Do.....	Fort Apache.....	81.9	27.0	89.0	1879	15.0 1883
Arkansas.....	Fort Smith.....	91.3	30.0	88.5	1883	30.1 1886
Do.....	Little Rock.....	89.8	33.5	94.0	1880	28.2 1886
California.....	San Francisco.....	78.5	43.7	81.0	1875	40.0 1875
Do.....	San Diego.....	79.6	44.4	87.0	1876	39.0 1875
Colorado.....	Denver.....	82.5	20.5	83.0	1874	4.0 1876
Do.....	Pike's Peak.....	37.5	6.2	39.0	1876	21.0 1875
Connecticut.....	New Haven.....	80.0	23.0	83.0	1885	16.0 1874
Do.....	New London.....	79.4	23.6	77.9	1885	19.0 1874
Dakota.....	Fort Buford.....	87.8	11.6	92.0	1881	7.0 1880
Do.....	Yankton.....	90.1	18.9	89.0	1874	3.0 1881
District of Columbia.....	Washington City.....	83.9	28.0	90.0	1872	22.5 1875
Florida.....	Jacksonville.....	88.7	37.6	91.0	1874, 1880	37.0 1881
Do.....	Key West.....	84.0	61.2	91.0	1881	61.0 1873, 1881
Georgia.....	Atlanta.....	88.1	36.3	86.0	1880	25.0 1881
Do.....	Savannah.....	89.0	35.5	89.0	1873	33.0 1881
Idaho.....	Boise City.....	86.3	22.4	80.0	1879	17.5 1883
Illinois.....	Cairo.....	87.0	32.9	89.0	1872	24.0 1875
Do.....	Chicago.....	82.2	19.1	83.0	1873	17.0 1875, 1879, 1881
Indiana.....	Indianapolis.....	85.0	22.4	85.3	1883	19.0 1875
Indian Territory.....	Fort Sill.....	95.0	35.0	96.0	1880	26.0 1881
Iowa.....	Dubuque.....	82.6	15.8	84.0	1879	13.8 1886
Do.....	Des Moines.....	86.8	18.1	89.0	1883	11.0 1881
Kansas.....	Dodge City.....	91.1	23.9	92.0	1880	13.0 1881
Do.....	Leavenworth.....	87.2	26.4	89.0	1880	13.0 1881
Kentucky.....	Louisville.....	87.0	30.3	88.5	1883	21.0 1875
Louisiana.....	New Orleans.....	86.8	48.5	86.0	1882	38.0 1881
Do.....	Shreveport.....	96.2	38.9	93.0	1880, 1882	32.0 1881
Maine.....	Eastport.....	66.2	20.5	71.3	1886	2.0 1874
Do.....	Portland.....	70.2	21.5	78.0	1881	14.0 1874
Maryland.....	Baltimore.....	85.0	29.5	87.8	1886	23.5 1875
Massachusetts.....	Boston.....	79.6	23.0	85.0	1872	11.0 1874
Michigan.....	Marquette.....	81.5	9.2	81.0	1877	3.0 1875
Do.....	Grand Haven.....	72.8	15.5	80.0	1883	9.0 1874
Minnesota.....	Saint Vincent.....	83.5	3.6	82.2	1886	14.4 1885
Do.....	Saint Paul.....	84.2	13.8	82.0	1879, 1882	7.0 1874
Mississippi.....	Vicksburg.....	92.0	42.6	91.4	1885	31.0 1881
Missouri.....	Saint Louis.....	86.7	31.6	87.5	1883	22.0 1875
Montana.....	Fort Assinaboine.....	78.6	24.1	81.0	1881	7.0 1881
Do.....	Helena.....	74.0	21.7	73.0	1881	6.0 1881
Nebraska.....	North Platte.....	93.2	18.0	92.0	1880	12.0 1875
Do.....	Omaha.....	88.0	23.4	89.0	1880	6.0 1881
Nevada.....	Winnemucca.....	81.1	21.8	79.0	1881	17.0 1883
New Hampshire.....	Mount Washington.....	42.1	8.3	56.5	1885	15.0 1874
New Jersey.....	Atlantic City.....	84.0	26.6	83.4	1886	19.0 1875
New Mexico.....	Santa Fe.....	72.2	23.4	84.0	1879	11.0 1875
New York.....	Buffalo.....	65.2	19.1	82.6	1883	11.0 1881
Do.....	New York City.....	80.3	25.8	84.0	1886	20.0 1874
North Carolina.....	Charlotte.....	89.3	32.1	86.6	1886	28.0 1881
Do.....	Wilmington.....	85.7	32.9	90.0	1880	28.0 1875
Ohio.....	Cincinnati.....	84.4	27.2	85.0	1872, 1873	18.0 1875
Do.....	Sandusky.....	81.1	19.3	83.9	1885	14.0 1881
Oregon.....	Portland.....	68.9	31.2	85.0	1880	28.0 1875
Do.....	Roseburg.....	77.0	27.5	84.5	1880	29.0 1878
Pennsylvania.....	Pittsburg.....	83.8	24.0	89.2	1885	14.0 1875
Do.....	Philadelphia.....	84.2	27.8	87.0	1872	17.5 1874
Rhode Island.....	Block Island.....	66.8	25.0	69.9	1885	25.0 1881
South Carolina.....	Charleston.....	85.3	33.4	87.0	1880	32.0 1881
Tennessee.....	Knoxville.....	88.7	29.1	88.0	1872	24.0 1875, 1881
Do.....	Memphis.....	87.2	38.4	88.0	1882, 1883	27.0 1881
Texas.....	Brownsville.....	91.7	50.7	97.8	1886	43.0 1881
Do.....	Fort Elliott.....	90.2	29.0	96.0	1880	20.0 1881
Utah.....	Salt Lake City.....	80.7	27.1	83.0	1874	19.0 1875
Virginia.....	Lynchburg.....	85.4	30.9	91.5	1873	25.0 1881
Do.....	Norfolk.....	84.5	31.5	92.0	1871	27.0 1875, 1880
Washington Ter.....	Spokane Falls.....	86.2	26.1	75.0	1885	26.0 1881
Do.....	Olympia.....	67.0	27.2	82.0	1880	28.0 1880
Wisconsin.....	La Crosse.....	79.1	11.5	83.0	1879	10.0 1881
Do.....	Milwaukee.....	77.8	17.6	82.0	1871	11.6 1886
Wyoming.....	Cheyenne.....	75.6	16.0	80.0	1874	2.0 1875

Nebraska.—1st, 3d, 4th, 5th, 7th, 11th, 12th, 15th, 16th, 17th, 20th, 22d to 28th.

Nevada.—Carson City, 3d, 4th, 6th to 12th, 14th, 16th to 19th, 21st to 24th, 27th, 30th; Winnemucca, 8th, 11th, 12th, 15th, 16th, 18th, 19th, 22d.

New Hampshire.—1st, 6th to 9th, 12th to 15th, 19th, 21st, 22d, 23d, 25th.

New Jersey.—1st, 2d, 3d, 6th to 9th, 19th, 20th, 21st, 25th.

New Mexico.—Fort Stanton, 1st, 2d, 4th to 7th, 13th, 14th, 15th, 24th, 25th, 26th; Gallinas Spring, 9th, 13th, 19th.

New York.—1st to 15th, 17th to 23d, 25th to 29th.

North Carolina.—Reidsville, 1st, 2d, 3d, 6th, 20th, 21st, 26th; Wash Woods, 2d, 3d, 6th, 7th, 8th; Hanging Dog, 2d, 3d, 24th; Statesville, 2d, 6th; Weldon, 3d, 6th, 9th; Lenoir, 6; Raleigh, 20th, 21st.

Ohio.—1st, 2d, 3d, 5th to 10th, 17th to 21st, 24th to 28th.

Oregon.—1st, 3d, 4th, 8th, 10th to 18th, 20th to 22d, 25th, 30th.

Pennsylvania.—1st to 11th, 13th to 30th.

Rhode Island.—Block Island, 15th.
South Carolina.—Aiken, 1st; Spartanburg, 2d, 3d, 5th, 6th, 9th, 10th, 19th, 26th; Stateburg, 2d, 6th.
Tennessee.—1st, 2d, 4th, 5th, 6th, 19th, 24th.
Texas.—Palestine, 1st; Fort Davis, 1st, 4th, 23d.
Utah.—9th, 12th, 13th, 16th, 21st, 22d.
Vermont.—1st, 2d, 3d, 6th, 7th, 8th, 12th, 13th, 14th, 18th, 19th, 20th, 22d, 26th, 27th, 28th.
Virginia.—1st, 2d, 3d, 6th, 7th, 9th, 20th, 21st, 22d, 26th.
Washington Territory.—3d, 4th, 13th, 14th, 15th, 18th, 21st, 22d, 23d, 25th, 29th, 30th.
West Virginia.—1st, 2d, 5th, 6th, 8th, 9th, 19th, 20th, 21st, 24th, 25th.
Wisconsin.—1st to 10th, 17th, 19th to 29th.
Wyoming.—3d, 4th, 9th to 11th, 13th to 15th, 18th to 26th.

ICE.

Ice formed in the southern parts of the country as follows:
Arkansas.—Lead Hill, 1st, 5th; Little Rock, 5th.
Georgia.—Athens and Forsyth, 2d, 6th.
North Carolina.—Weldon, 3d, 6th; Lenoir, 6th.
Tennessee.—Milan, 1st; Ashwood, 1st, 2d; Nashville, 5th, 6th.
Texas.—Corsicana, 1st.

TEMPERATURE OF WATER.

The following table shows the maximum, minimum, and mean water temperature, as observed at the harbors of the several stations; the monthly range of water temperature; the average depth at which the observations were made, and the mean temperature of the air:

Temperature of water for April, 1887.

Station	Temperature at bottom.				Mean temperature of the air at station.	Average depth of water, feet and tenths.
	Max.	Min.	Range.	Monthly mean.		
Cedar Keys, Fla.....	68.9	60.0	8.9	65.8	67.3	8.1
Charleston, S. C. *.....	68.3	53.5	14.8	62.2	62.6	36.2
Eastport, Me.....	38.2	35.4	3.4	36.6	37.5	12.9
Galveston, Tex.....	76.8	64.8	12.0	71.5	69.4	14.5
Key West, Fla.....	86.2	70.6	15.6	78.5	74.3	20.3
New London, Conn.....	46.5	36.5	10.0	41.3	45.0	11.5
New York City.....	45.3	36.5	8.8	41.3	47.7	15.2
Pensacola, Fla.....	70.0	63.3	12.7	69.0	67.2	17.7
Portland, Me.....	42.0	34.8	7.2	38.4	40.1	16.8
Portland, Oregon.....	52.7	46.6	6.1	48.7	50.2	58.1

* Record for 29 days.

PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for April, 1887, as determined from the reports of about six hundred stations, is exhibited on chart iii. In the table of miscellaneous meteorological data are given, for each Signal Service station, the total precipitation, with the departures from the normal. The figures above the several geographical districts show the average precipitation and the average excess or deficiency as compared with the normal of each district. The normal for any district may be found by adding the departure to the current mean when the departure is below normal, and subtracting when above.

The precipitation of the month over the entire country east of the Rocky Mountains is generally considerably below the normal, although there are in these districts several large areas in which an excess occurs. The more important of these areas of excess comprises the greater part of Canada, the upper lake region, southern Minnesota, southern Dakota, eastern Wyoming, eastern Colorado, and western Nebraska; the excess is small in the central and western parts of this large area, but in Nova Scotia departures as large as 3.08 in excess of the normal occur. A second area of excessive rainfall embraces the Ohio Valley, Maryland, Delaware, and northern Virginia, within which the departures vary from 0.35 at Washington City to 2.79 at Louisville, Ky. In the southeastern quarter of the country very little rain has fallen during the month, and deficiencies ranging from three to six inches occur in the southern part of the Mississippi Valley and eastern Texas. Most of the precipitation of the Gulf States fell on the 17th, 18th, 22d, and 23d, and was immediately absorbed by the dry soil. At two stations in Florida, Cedar Keys and Jacksonville, an excess of rain fell. The long drought continues in southern and eastern Texas, the rainfall at all stations in these parts of the state being less than one inch, and at several stations none fell, although the normal amount is from three to four inches. In northwestern Texas and the western part of the Indian Territory the drought was broken by several rains; the rains of the 13-14th and 17-18th were heavy and the precipitation of this region is above the normal. The depression of the 22d was accompanied in the Ohio Valley, lower lakes, and Tennessee by unusually heavy rainfall; in Tennessee the greater part of the precipitation of the month fell on this date. All stations in the plateau region and western slope of the Rocky Mountains, except San Francisco and Sacramento, Cal., show an excess of precipitation, but the departures are not large, except along the coast of Washington Territory and Oregon,

where the continuous rainfall of the month has retarded agricultural operations.

The following are some of the most marked departures from the normal precipitation at Signal Service stations:

Above normal.		Below normal.	
Inches.		Inches.	
Tatoosh Island, Wash.....	4.94	Vicksburg, Miss.....	6.51
Fort Elliott, Tex.....	4.48	Shreveport, La.....	5.58
Cedar Keys, Fla.....	4.25	Little Rock, Ark.....	5.30
Astoria, Oregon.....	3.29	Montgomery, Ala.....	5.16
Louisville, Ky.....	2.79	Pensacola, Fla.....	4.38
Cincinnati, Ohio.....	2.69	New Orleans, La.....	4.27
Portland, Me.....	2.02	Mobile, Ala.....	4.03

DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows, for certain stations, as reported by voluntary observers, the average precipitation for the month of April for a series of years, the precipitation for April 1887, and the departures from the average:

Station.	County.	Average precipitation for April.	Number of years.	Precipitation for April, 1887.	Departure.
Arkansas.		Inches.		Inches.	Inches.
Lead Hill.....	Boone.....	5.02	5	3.02	- 2.00
California.					
Sacramento.....	Sacramento.....	2.07	21	2.99	+ 0.92
Connecticut.					
Canton *.....	Hartford.....	3.39	26	3.10	- 0.29
Hartford.....	Hartford.....	3.30	16	3.49	+ 0.19
Middletown *.....	Middlesex.....	3.26	29	3.00	- 0.26
Wallingford *.....	New Haven.....	3.74	30	3.19	- 0.55
Dakota.					
Webster.....	Day.....	4.87	4	3.94	- 0.93
Florida.					
Archer.....	Alachua.....	3.88	4	7.75	+ 3.87
Illinois.					
Collinsville.....	Madison.....	3.24	5	3.99	+ 0.75
Mattoon.....	Coles.....	4.02	7	2.93	- 1.09
Peoria.....	Peoria.....	3.11	31	1.53	- 1.58
Sycamore.....	De Kalb.....	4.02	6	1.08	- 2.94
Sandwich.....	De Kalb.....	3.55	35	0.57	- 2.98
Indiana.					
Lafayette.....	Tippecanoe.....	3.28	8	2.94	- 0.34
Logansport.....	Cass.....	2.65	33	2.10	- 0.55
Vevay.....	Switzerland.....	3.40	21	7.07	+ 3.67
Iowa.					
Cresco.....	Howard.....	2.12	15	1.94	- 0.18
Monticello.....	Jones.....	2.56	34	0.83	- 1.73
Kansas.					
Independence.....	Montgomery.....	4.46	15	3.23	- 1.23
Wellington.....	Sumner.....	2.81	9	3.23	+ 0.42
Louisiana.					
Grand Coteau.....	Saint Landry.....	5.66	5	1.77	- 3.89
Maine.					
Cornish.....	York.....	2.84	30	3.86	+ 1.02
Orono *.....	Penobscot.....	3.04	19	5.08	+ 2.04

Deviations from average precipitation—Continued.

Station.	County.	Average pre- cipitation for April.	Number of years.	Precipitation for April, 1887.	Departure
<i>Maryland.</i>		<i>Inches.</i>		<i>Inches.</i>	<i>Inches.</i>
Fallston	Harford	3.74	16	2.51	- 0.63
<i>Massachusetts.</i>					
Amherst	Hampshire	3.14	52	2.78	- 0.36
Cambridge	Middlesex	3.75	46	5.46	+ 1.71
Chestnut Hill	Middlesex	3.63	12	4.74	+ 1.11
Framingham	Middlesex	3.38	13	4.60	+ 1.22
Lake Cochituate	Middlesex	4.09	30	4.45	+ 0.36
Ludlow	Hampden	2.60	12	2.76	+ 0.16
Lynn	Essex	3.77	13	5.24	+ 1.47
Myatic Lake	Middlesex	3.33	12	4.53	+ 1.19
New Bedford	Bristol	3.97	74	5.45	+ 1.48
Somerset	Hampden	3.57	17	4.29	+ 0.72
Springfield	Hampden	3.35	40	3.43	+ 0.08
Waltham	Middlesex	3.75	63	4.76	+ 1.01
Williamstown	Berkshire	2.47	21	3.23	+ 0.76
<i>Nevada.</i>					
Carson City	Ormsby	1.42	8	0.65	- 0.77
<i>New Brunswick.</i>					
Saint John	Saint John	3.49	27	3.65	+ 0.16
<i>New Hampshire.</i>					
Concord	Merrimack	2.72	31	2.94	+ 0.22
Hanover	Grafton	1.91	23	1.54	- 0.37
<i>New Jersey.</i>					
Dover	Morris	2.68	4	2.20	- 0.48
South Orange	Essex	2.91	17	2.26	- 0.65
<i>New York.</i>					
Factorville	Tioga	1.76	5	1.45	- 0.31
Palermo	Oswego	2.43	33	1.12	- 1.31
<i>Ohio.</i>					
Wauseon	Fulton	2.52	14	1.52	- 1.00
<i>South Carolina.</i>					
Kirkwood	Kershaw	3.60	20	1.91	- 1.69
Stateburg	Sumter	2.63	7	1.81	- 0.82
<i>Texas.</i>					
New Ulm	Austin	3.84	15	0.17	- 3.67
<i>Vermont.</i>					
Lunenburg	Essex	2.74	36	1.75	- 0.99
Newport	Orleans	2.67	13	2.77	+ 0.10
Strafford	Orange	2.33	13	2.50	+ 0.17
<i>Virginia.</i>					
Bird's Nest	Northampton	3.33	18	2.80	- 0.53
Dale Enterprise	Rockingham	4.11	7	5.21	+ 1.10
Variety Mills	Nelson	2.72	8	3.11	+ 0.39
Wytheville	Wythe	3.59	23	2.98	- 0.61
<i>West Virginia.</i>					
Helvetia	Randolph	3.95	11	4.91	+ 0.96

* From the "Bulletin of the New England Meteorological Society."

The following notes in connection with this subject are furnished by voluntary observers:

Alabama.—Livingston, Sumter Co.: the normal precipitation of the first four months of the year is 24.77; the total amount of the corresponding months of the current year is 13.05 below the normal.

Indiana.—Logansport, Cass Co.: the snowfall of the month, 4.40, is 2.07 above the average April snowfall of the past thirty-three years; in that time the greatest April precipitation, 7.30, fell in 1864, and the least, 1.42, in 1870.

Iowa.—Monticello, Jones Co.: during the past thirty-four years the largest April precipitation, 5.78, fell in 1862; the least, 0.63, in 1863.

Kansas.—Wellington, Sumner Co.: during the past nine years the largest April precipitation, 4.84, fell in 1885; the least, 0.54, in 1880.

Maine.—Cornish, York Co.: the snowfall of the present month, fourteen inches, is five inches above the average April snowfall of the past thirty years.

Maryland.—Fallston, Harford Co.: during the past sixteen years the largest April precipitation, 8.11, fell in 1874; the least, 1.28, in 1881.

Cumberland, Alleghany Co.: table of April precipitation in the past fifteen years:

Year.	Precipitation.	Year.	Precipitation.
	<i>Inches.</i>		<i>Inches.</i>
1873	2.30	1882	4.53
1874	6.50	1883	2.57
1875	1.20	1884	1.96
1876	1.30	1885	1.79
1877	2.20	1886	2.18
1878	2.10	1887	2.61
1879	0.60		
1880	2.44	Average	2.40
1881	1.72		

Massachusetts.—Worcester, Worcester Co.: the normal precipitation for April is 3.65; snow four inches; during April, 1887, the rain and melted snow aggregated 2.84; the unmelted snow, 17.8 inches, the heaviest snowfall in April for half a century.

Pennsylvania.—Dyberry, Wayne Co.: the total snowfall of the past winter, 128 inches, is 59 inches more than the average of the past thirty-three years.

South Carolina.—Stateburg, Sumter Co.: during the past seven years the largest April precipitation, 4.17, occurred in 1883; the least, 1.24, in 1885.

Virginia.—Dale Enterprise, Rockingham Co.: in the past seven years the largest April precipitation, 7.13, occurred in 1882; the least, 0.75, in 1881.

Table of excessive and greatest monthly precipitation for April, 1887.

Station.	Specially heavy.	Largest monthly.	Station.	Specially heavy.	Largest monthly.
	Date.	Amt.		Date.	Amt.
<i>Alabama.</i>			<i>Massachusetts.</i>		
Carrollton	22	2.88	Nantucket a		7.17
Florence	22	2.00	Nantucket b		6.23
Valley Head	22, 23	3.15	<i>Missouri.</i>		
<i>Colorado.</i>			Troy		6.20
Pike's Peak	12, 13	2.64	<i>Nebraska.</i>		
<i>Dakota.</i>			Fort Niobrara	12, 13, 14	3.36
Deadwood	21, 22	2.54	<i>Nevada.</i>		
<i>Florida.</i>			Fort McDermitt	11	2.30
Merritt's Island		8.24	<i>North Carolina.</i>		
Archer	24, 25	4.50	Lenoir	22	2.80
Alva	14	2.00	Flat Rock	23	2.50
Duke	23, 24	2.07	<i>Ohio.</i>		
Tallahassee	23, 24, 25	4.10	Georgetown	18	2.70
Manatee	13, 14	2.72	Do	22, 23	3.29
Cedar Keys	23, 24	3.63	Waverly	18	2.84
<i>Georgia.</i>			Do	22	2.40
Quitman	23, 24, 25	3.20	Logan	18	2.91
Forsyth	22, 23	2.22	Clarksville	22	2.02
<i>Illinois.</i>			Portsmouth	21, 22	3.15
Summer	22	2.70	College Hill	17	2.50
Olney	17, 18	2.40	Do	22	3.25
Do	21, 22	2.48	West Milton	22	2.00
Flora	22	2.25	Jacksonborough	17, 18	2.00
Centralia	22	2.20	Willow Springs	22	2.24
Mount Carmel	17, 18	2.42	Ruggles	18	2.00
Albion	17	2.20	Cincinnati	17, 18	2.36
Do	22	2.42	Newcomertown	18	2.07
Fairfield	18, 19	2.13	Hanging Rock	22	3.40
Do	22, 23	2.00	Washington C.H.	18	2.58
<i>Indiana.</i>			McConnellsville	18	2.49
Jeffersonville	17, 18	2.97	<i>Oregon.</i>		
Do	21, 22	3.76	Mount Angel		6.93
Vevay	18	2.00	Astoria		6.83
Do	21, 22	3.67	Bandon		6.47
Sunman	21, 22	2.63	<i>Pennsylvania.</i>		
Lancaster	17, 18	2.87	Pittsburg	29, 30	2.60
Do	22, 23	2.35	<i>Tennessee.</i>		
Butler	22	2.01	Farmingdale	22, 23	2.07
<i>Kansas.</i>			Chattanooga	22, 23	2.64
W. Leavenworth	16, 17	3.80	Knoxville	22, 23	2.37
Wellington	16	2.43	Grief	22	2.00
<i>Kentucky.</i>			Fostoria	22, 23	2.80
Louisville	22, 23	3.70	Manchester	22	2.28
Frankfort	17, 18	2.72	Fayetteville	22	2.09
Do	22	3.17	Parksville	23	2.47
Midway	22	2.06	<i>Texas.</i>		
Bowling Green	18	2.01	Fort Elliott		6.06
<i>Maine.</i>			<i>Virginia.</i>		
Kent's Hill	28, 29, 30	3.08	Rappahannock	18	2.38
Orono	28, 29, 30	3.26	Washington Ter.		
Bar Harbor	28, 29, 30	2.82	Tatoosh Island		8.51
			Fort Spokane	10, 11	2.00

SNOW.

The dates on which snow fell in the various states and territories are as follows:

Arizona.—8th, 10th to 14th, 16th, 17th.

California.—Fort Bidwell, 7th, 9th, 12th, 20th, 30th.

Colorado.—8th to 18th, 20th, 23d to 25th.

Connecticut.—1st, 2d, 13th, 18th, 19th, 26th.

Dakota.—3d, 9th to 16th, 19th, 21st to 24th.

Delaware.—Cape Henlopen, 1st, 2d.

District of Columbia.—Washington City, 1st, 2d.

Idaho.—2d, 10th, 11th, 17th, 30th.

Illinois.—1st, 4th, 14th, 18th.

Indiana.—1st, 4th, 18th, 24th.

Iowa.—3d, 4th, 17th, 21st to 24th, 26th.

Kansas.—Wyandotte, 17th; Fort Hays and Belleville, 22d.

Maine.—1st to 6th, 16th to 20th, 26th, 27th.

Maryland.—1st, 2d, 5th.

Massachusetts.—1st, 2d, 3d, 8th, 18th, 19th, 23d, 26th.

Michigan.—1st, 2d, 4th to 7th, 15th, 16th, 18th, 22d to 26th.

Minnesota.—2d, 3d, 4th, 10th, 22d to 25th.

Missouri.—Saint Louis, 18th.

Montana.—3d, 9th, 11th, 12th, 14th, 15th, 17th, 20th to 23d, 30th.

Nebraska.—2d, 3d, 13th, 14th, 16th, 17th, 19th, 21st to 24th.

Nevada.—9th, 10th, 11th, 30th.

New Hampshire.—1st, 2d, 4th to 6th, 9th, 10th, 15th to 18th, 26th to 30th.

New Jersey.—1st, 2d, 18th, 19th.

New Mexico.—Fort Wingate, 10th, 11th, 12th, 16th; Santa Fé, 12th, 13th; Fort Union, 12th, 16th, 23d, 24th; Fort Bayard, 13th; Gallinas Spring, 24th.

New York.—1st, 2d, 4th, 5th, 6th, 12th, 14th, 16th to 19th.
North Carolina.—Charlotte, 1st; Raleigh and Weldon, 1st, 2d.
Ohio.—1st to 7th, 18th.
Oregon.—9th, 10th, 11th, 20th, 29th, 30th.
Pennsylvania.—1st, 2d, 4th, 5th, 17th, 18th, 19th, 29th.
Rhode Island.—1st, 2d, 18th.
South Carolina.—Spartanburg and Stateburg, 1st.
Utah.—8th to 12th, 14th, 15th, 17th, 18th, 21st, 23d, 24th, 30th.
Vermont.—5th, 17th, 18th, 19th, 27th, 30th.
Virginia.—1st, 2d, 25th, 26th.
Washington Territory.—2d, 11th, 29th, 30th.
West Virginia.—Clarksburg, 5th.
Wisconsin.—3d, 4th, 5th, 22d to 25th.
Wyoming.—3d, 10th to 15th, 17th, 18th, 21st to 23d, 30th.

MONTHLY SNOWFALLS.

[Expressed in inches and tenths.]

The following stations report a monthly snowfall of two inches or more:

California.—Summit, 58; Cisco, 38; Emigrant Gap, 24; Truckee, 20; Tehachapi, 2.

Colorado.—Pike's Peak, 50.2; Las Animas, 3.

Connecticut.—North Colebrook, 14; Canton, 9; Collinsville, 8.7; Middletown, 7; Hartford, 6; New Haven, 3.

Dakota.—Deadwood, 45.1; Fort Buford, 8.

Illinois.—Paris, 3; Eberle, 2.5; Mason City and Griggsville, 2.

Indiana.—Logansport, 4.4; Fort Wayne, 3.

Iowa.—Bancroft, 2.

Maine.—Portland, 16.6; Belfast, 16; Cornish and Orono, 14; Kent's Hill, 12; Lewiston, 11.5; Eastport, 7.9; Mayfield, 6.5; Bar Harbor, 4.

Maryland.—Fallston, 4; New Midway, 3.

Massachusetts.—Newburyport, 20.5; Randolph and Fall River, 20; Blue Hill Observatory (base), 19; Worcester, 17.8; Milton and Taunton a, 17; Taunton b, 16; Concord, 15.1; Chestnut Hill, Lawrence, New Bedford a, South Hingham, and Boston, 15; New Bedford b, 14.5; Somerset, 14; Cambridge, 13; Cotuit and Monson, 12; Worcester and Fitchburg a, 11.2; Westborough, 11; Fitchburg b and North Truro, 9.5; Springfield, 8.6; Dudley, 8; Amherst a, 7.7; Ludlow, 7; Nantucket, 6.8; Amherst b, 6.5; Rowe, 6; Williamstown, 4.

Michigan.—Marquette, 14.4; Swartz Creek, 7.2; Escanaba, 5.3; Lansing a, 3.5; Hudson, 3.4; Lansing b, 3.3; Alma and Ovid, 3; Greenville and Birmingham, 2.7; Mackinaw City and Traverse City, 2.5; Alpena, 2.3; Thornville and Kalamazoo, 2.

Minnesota.—Red Wing, 11; Rochester, 9; Duluth, 8.3; Winona, 6; Albert Lea, 5.5; Sherburne, 4.6; Minneapolis, 4.4; Mankato, 4; Moorhead, 2.8; Saint Vincent, 2.5.

Missouri.—Saint Louis, 4.

Montana.—Fort Maginnis, 18.4; Helena, 4.3; Poplar River, 3.4.

Nebraska.—North Platte, 4.4; Hay Springs, 3.

Nevada.—Toano, 9.8; Otego, 5.4; Winnemucca, 3.3; Tacoma, 3.

New Hampshire.—Mount Washington, 39.6; Nashua and Manchester a, 11; Concord a, 8; Berlin Mills, 7.5; Manchester b and Concord b, 7; Walpole, 5.5; West Milan, 4.5; Shelburne, 4; Manchester c, 2.7; Hanover, Quincy, and Stratford, 2.

New Jersey.—Vineland, 7; Dover, 6.5; South Orange, 4.5; Atlantic City, Roseland, and Clayton, 4; Beverly, 2.8; Moorestown and Egg Harbor City, 2.

New Mexico.—Santa Fé, 5.

New York.—Factoryville, 8.5; White Plains, 8; North Concord, 7.5; Auburn and Humphrey, 7; Penn Yan, Setauket, and Lebanon Springs, 6; Boyd's Corners, 5.7; Menands, 4.5; New York City, 4.1; Brooklyn, 4; Albany, 3.5; Cooperstown and Le Roy, 3; Buffalo, 2.6; Ithaca, 2.

North Carolina.—Raleigh, 17.

Ohio.—Cleveland a, 9.9; Tiffin a, 9; Tiffin b, 7; Hiram, 6.5;

Ruggles, 6; Garrettsville, 5.5; Sandusky, 5; Cleveland b, 4; Napoleon, 3.2; Wauseon and Toledo, 2.4.

Pennsylvania.—Dyberry, 14; Blooming Grove, 11.5; Wellsborough, 10.2; Wilkesbarre and Wysox, 10; Grampian Hills, 8; West Chester, 6; Bethlehem, 5.5; Fallsington, 3.8; State College, 3.1; Phillipsburg, 3.

Rhode Island.—Block Island, 13.2; Bristol, 11.5; Woonsocket, 10.2; Providence, 10; Olneyville, 9.

Utah.—Frisco, 5.5; Corinne, 4; Salt Lake City, 2.5.

Vermont.—Marlborough, 9.6; Jacksonville, 6.2; Vernon, 5; Townshend, 4.5; Brattleborough, 4.2; Lunenburg and Strafford, 4; Northfield, 3.

Virginia.—Bird's Nest, 2.

Wisconsin.—Eau Claire, 9; La Crosse, 3; Wausau, 2.5.

Wyoming.—Cheyenne, 12.

DEPTH OF UNMELTED SNOW ON GROUND AT END OF MONTH.

[Expressed in inches and tenths.]

Colorado.—Pike's Peak, 13.

Dakota.—Deadwood, 3.

New Hampshire.—Mount Washington, 20.

Utah.—Salt Lake City, 0.7; Frisco, 0.5.

HAIL.

Mason City, Cerro Gordo Co., Iowa: at 2.30 p. m. of the 14th a heavy thunder-storm, accompanied by hail, set in. The hail fell in large quantities for about fifteen minutes and struck the ground with great force; a number of windows were broken. During the storm a barn in the southeast part of the town was struck by lightning and burned. A severe thunder-storm occurred during the same afternoon at Winona, in the southeastern part of the state. The rainfall was large, and was accompanied for ten minutes by a heavy fall of hail.

Lockport, Niagara Co., N. Y.: a heavy rain storm, accompanied by hail and vivid lightning, passed over this town between 4 and 5 p. m. of the 15th. Hail as large as chestnuts fell to a depth of two inches.

Stateburg, Sumter Co., S. C.: during a heavy thunder-storm on the afternoon of the 15th hail fell, more or less heavily, over a belt several miles in width, extending from Claremont Depot to Providence, a distance of about ten miles.

Yazoo, Yazoo Co., Miss.: rain fell during the afternoon of the 21st and was accompanied by a very severe hail storm. Stones fell for a few minutes as large as hens' eggs, breaking windows and beating leaves and young fruit from trees. Much damage was done to growing crops. At Rolling Fork, Sharkey Co., several stones were found that measured five inches in circumference. Holes were broken in roofs, and trees were partly stripped of foliage.

Strawberry Plains, Jefferson Co., Tenn.: on the afternoon of the 28th this county was visited by a heavy thunder-storm, with destructive hail. The stones were about the size of partridge eggs and fell to considerable depth, doing much damage to vegetation.

Reidsville, Rockingham Co., N. C.: on the 29th, five miles northwest of this place, hail fell in large quantities. Some of the stones were over an inch in diameter.

Hail is also reported to have occurred as follows:

Alabama.—Livingstone, 18th; Mobile and Montgomery, 23d.

Arizona.—Prescott, 8th, 15th, 16th; Fort McDowell, 10th; Fort Bowie and Fort Grant, 12th.

Arkansas.—Little Rock, 4th; Fort Smith, 22d; Lead Hill, 25th.

California.—Benicia Barracks, 10th; Fort Bidwell, 20th.

Colorado.—Denver, 13th; Montrose, 17th.

Dakota.—Fort Totten, 2d; Huron, 10th; Fort Pembina, 10th, 22d; Fort Yates, 11th; Fort Abraham Lincoln, 19th; Webster, 22d, 25th.

Delaware.—Cape Henlopen, 19th.

Florida.—Jacksonville, 23d.

Georgia.—Quitman, 8th.

Idaho.—Boisé City, 2d; Fort Sherman, 2d, 17th; Cœur d'Alene, 2d, 17th, 18th; Boisé Barracks, 20th.

Illinois.—Cairo and Windsor, 21st; Rockford, 24th.
Indiana.—Jeffersonville, 14th; Logansport, 24th, 28th; Butlerville, Laconia, and Vevay, 28th.
Indian Territory.—Fort Reno, 22d.
Iowa.—Des Moines, 10th; Dubuque, 22d; Keokuk, 25th, 27th; Clinton, 27th.
Kansas.—Fort Hays, 20th; Globe, Marydale Farm, Manhattan, and Wakefield, 21st; Independence, 22d; El Dorado, 27th.
Kentucky.—Harper's Ferry, 28th.
Maryland.—Ocean City, 18th.
Michigan.—Mackinaw City, 4th; Lansing, 29th.
Minnesota.—Moorhead, 11th; Saint Paul, 14th.
Mississippi.—Vicksburg, 21st.
Missouri.—Saint Louis, 21st, 22d; Centreville, 26th; Springfield, 30th.
Montana.—Poplar River, 30th.
Nebraska.—Fort Robinson, Omaha, and Valentine, 10th; Marquette, 23d.
Nevada.—Winnemucca, 20th.
New Jersey.—Beverly, Dover, and Moorestown, 18th.
New Mexico.—Santa Fé, 16th, 18th; Fort Union, 19th.
New York.—Menands, 12th; Palmyra, 14th; Rochester, 15th; Setauket, 18th; Humphrey, 21st, Oswego, 23d.
North Carolina.—Reidsville, 1st; Smithville, 20th.
Ohio.—Jacksonborough, 15th, 18th; Sandusky, Elyria, and Garrettsville, 18th; Toledo, 27th; Napoleon, Portsmouth, Wauseon, Westerville, and Yellow Springs, 28th.
Oregon.—Albany, 2d, 10th, 12th, 17th, 30th; East Portland, 14th; Portland, 17th, 29th, 30th.
Pennsylvania.—Dyberry, 15th; Bethlehem, Fallsington, Grampian Hills, Quakertown, and Wellsborough, 18th; Pittsburgh, 28th.
South Carolina.—Spartanburg, 15th; Stateburg, 15th, 16th; Kirkwood, 16th.
Tennessee.—Nashville, 28th.
Texas.—Fort Davis, 8th, 12th; Silver Falls, 12th; Cleburne, 30th.
Utah.—Frisco, 16th.
Vermont.—Charlotte, 28th.
Virginia.—Wytheville and Dale Enterprise, 15th; Lynchburg and University of Virginia, 18th, 28th; Marion and Variety Mills, 28th.
Washington Territory.—Fort Townsend, 17th; Spokane Falls, 24th.
West Virginia.—Middlebrook, 15th; Parkersburg, 27th, 28th.
Wisconsin.—Madison, 22d; Beloit, 24th; Green Bay, 28th.
Wyoming.—Fort Laramie, 18th.

SLEET.

Sleet fell in the various states and territories during the month, as follows: Fort Apache, Ariz., 11th; Lead Hill, Ark., 4th; North Colebrook, Conn., 13th, 18th; New Haven, Conn., 18th; Fort Totten, Dak., 9th, 10th, 11th, 14th; Bismarck, Dak., 11th; Fort Sully, Dak., 22d; Charleston, Ill., 18th; Jacksonville, Ill., 20th; Indianapolis, Ind., 17th, 18th; Keo-

kuk, Iowa, 17th; Cresco and Cedar Rapids, Iowa, 24th; Eastport, Me., 2d, 3d; Boston, Mass., 18th; Fort Brady, Mich., 3d, 11th; Marquette, Mich., 11th; Central College, Mo., 17th, 18th; Valentine, Nebr., 14th, 22d; Hay Springs, Nebr., 21st, 22d, 23d; Beverly, N. J., 18th; New York City, 18th; Garrettsville and Tiffin, Ohio, 18th; Wauseon, Ohio, 18th, 24th, 27th; Bethlehem, Pa., 18th; Erie, Pa., 26th; Frisco, Utah, 30th; Norfolk, Va., 1st; La Crosse, Wis., 22d; Milwaukee, Wis., 23d, 24th.

DROUGHT.

Although rain accompanied the area of low that crossed Texas, the Indian Territory, and Kansas on the 18th, yet at the end of the month the long drought was practically unbroken, except in Kansas, where the rainfall of the 18th was quite heavy. In Texas the drought now extends from the western grazing country eastward to Louisiana, but decreases in severity as it approaches the eastern boundary. In central and eastern Texas, embracing the principal cotton-growing counties of the state, only a few light showers have fallen during the month. Reports from places in Missouri, Iowa, and northern Illinois state that crops were suffering from the lack of rain; in central Missouri considerable rain fell during the latter half of the month.

The following notes are from observers:

At San Antonio, Tex., although light rain fell on the 4th, 9th, 10th, 11th, 13th, 14th, and 16th, the total precipitation of the month was only 0.60 of an inch. Reports from adjoining counties indicate that their condition is even worse than the country immediately adjacent to San Antonio. The observer states that the dry grass from last year is exhausted, and as none has grown this spring the only forage for cattle is the prickly pear. Stock are dying rapidly. Numbers of families have deserted their homes and farms in search of a more favored locality. All hope of making the usual grain crop this season has been abandoned.

New Ulm, Austin Co., Tex.: all interests are suffering from the drought; cattle are in need of grass and water; corn and cotton are in bad condition and will have to be replanted if rain falls. The normal April rainfall for this section, as deduced from the observations of the past fifteen years, is 3.84 inches; the total of the current month is only 0.17 inch, and is the least that has fallen in any April during that time. The normal rainfall of the seven months ending April 30th is 31.70 inches; the total amount of the corresponding months in 1886-'87 is 7.92, a deficiency of 23.78. In 1873 eight inches of rain fell in April.

Bellefonte, Republic Co., Kans.: the first seventeen days of the month were remarkable for dry weather and the frequency and force of dust storms. On the 3d and 9th, during wind storms, dust filled the air to such an extent that buildings one hundred feet distant were visible only at intervals.

Independence, Montgomery Co., Kans.: the first heavy rain in this section since September 4, 1886, fell on the 16th and 17th. On the 3d, during a wind storm, the sky was obscured by dust.

Salina, Salina Co., Kans.: the month has been unusually dry, the total precipitation, 2.06 inches, being the least that has fallen in any April during the past five years.

Grand Coteau, Saint Landry Parish, La.: the total amount of rainfall for the five months from December, 1886, to April, 1887, inclusive, 12.20 inches, is less than one-half of the normal amount; the soil is dry and crops late.

Vicksburg, Miss.: on the 18th a gale, with very heavy rain, occurred, breaking the drought that had prevailed throughout this section. Crops of all kinds were backward, and, except where irrigated by the overflow of the river, no cotton had made its appearance above ground.

Tucson, Ariz.: cattle are dying in large numbers from want of water and food; the Rillito River is dry for the first time in many years.

WINDS.

The most frequent directions of the wind during April, 1887, are shown on chart ii by the arrows flying with the wind; they are also given in the table of miscellaneous data. The general movement of the air along the Atlantic coast, in New England, and the Middle States, has been from the northwest; in the Gulf States, Ohio Valley, Lake region, and the central Mississippi valley, from the south or southwest; in Dakota and the Missouri Valley, from the north or northwest; in California, from the west or northwest. In the remaining districts no general direction has prevailed.

HIGH WINDS (in miles per hour).

Wind-velocities of fifty or more miles per hour, other than

the maximum velocities for the month, which are given in the table of miscellaneous data:

Mount Washington, N. H., 60, ne., 2d; 92, nw., 3d; 89, nw., 6th; 71, nw., 8th; 92, nw., 10th; 96, nw., 11th; 61, nw., 12th; 58, nw., 13th; 50, nw., 18th; 59, n., 19th; 58, nw., 20th; 66, s., 23d; 51, s., 24th; 50, nw., 25th; 62, nw., 26th; 70, nw., 27th; 78, s., 28th; 60, se., 29th; 85, nw., 30th.

Pike's Peak, Colo., 59, nw., 1st; 65, w., 3d; 58, w., 4th; 52, sw., 11th; 52, nw., 19th; 70, w., 20th; 52, nw., 22d; 60, n., 25th; 52, w., 26th.

Dodge City, Kans., 51, nw., 22d.

Fort Elliott, Tex., 56, nw., 22d.

Report of tornadoes for the month of April, 1887, by Lieut. John P. Finley, Signal Corps, U. S. Army, Assistant.

Place.	Date.	Time.	Direction.	Form of cloud.	Number of persons killed.	Number of persons wounded.	Width of path.	Number and kind of animals killed.	Number and kind of buildings destroyed.	Total valuation of property destroyed.	Authority.
Ackworth, Ga.	3	8.30 p. m.	e.	.....	None	None	Feet.	.....	4 houses destroyed and several damaged.	.....	D. B. Painter, Dayton, Tenn.
Beaudry, Minn. a	9	4 to 5 p. m.	ne.	Cone	None	None	Narrow	.....	Several houses.	.....	J. T. Beaudry, Beaudry, Minn.
Fairport, N. Y.	13	5 p. m.	e.	Funnel	None	None	Narrow	.....	Several houses and barns.	.....	Dr. M. A. Veeder, Lyons, N. Y.
Saint Clairville and Martin's Ferry, Ohio. b	15	3.20 p. m.	ne.	Funnel	None	Many	90 to 600	Several horses and cattle.	About 200 of all kinds.	\$250,000	Judge John S. Cochran, Martin's Ferry, Ohio; A. V. McDonald, Burton, W. Va.; John Cook, Bridgeport, and J. P. Harvey, Union, Ohio.
Pittsburgh, N. C.	18	Noon	.....	.....	None	Several	1,200	.....	Many houses and out-buildings.	.....	T. B. Farrar, Belvoir, N. C.
Myrtle Station, Va. c	18	6.30 p. m.	ne.	Funnel	2	Several	300 to 600	Many	A great many houses, barns, and out-buildings.	.....	W. M. Bealon, Boykins, J. R. Purdie, Smithfield, F. A. Heines, Suffolk, and G. T. Atkins, Myrtle Station, Va.
Jonesborough, Ala. d	18	3 a. m.	ne.	Funnel	None	None	Narrow	.....	Many houses and out-buildings.	.....	Dr. Frank Prince, Jonesborough, Ala.
Ridgedale, Tenn. e	18	4.30 a. m.	ne.	Funnel	None	None	Narrow	.....	Many	10,000	The Chattanooga "Commercial" and Signal Service observer, Chattanooga, Tenn.
Prescott, Kans. f	21	5.30 p. m.	e., ne.	Funnel	20	237	600 to 2,640	.....	330 of all kinds	1,000,000	W. Fred Gentle, Mound City, F. R. Gray, Yates Centre, J. E. Ireland, Iola, C. E. Duvall, Lone Elm, D. P. Carson, Blue Mound, Dr. G. M. Haines, La Harpe, Kans.; S. G. Craig, Ohio, D. N. Hill, Hume, and J. F. Llewellyn, Mexico, Mo.
Mossom Prairie, Tex.	22	8.30 a. m.	ne.	.....	None	None	Narrow	.....	Several houses, stores, and out-buildings.	4,200	Dr. R. Deming, Mossville, Tex.
Carmi, Ill. g	22	11.45 p. m.	ne.	.....	None	None	Narrow	A large number of birds by hail.	.....	.....	Daniel Berry, Carmi, Ill.
Millport, Ala. h	22	6 p. m.	.....	Funnel	None	None	900	None	Many	.....	D. C. Hodo, Carrollton, Ala.
Near Cave Springs, Ga. i	22	8 p. m.	easterly	.....	None	None	300	Considerable	Many barns, cabins, fences, and trees.	.....	J. H. Dent, Cave Spring, Ga.
Atchison, Kans.	22	2.30 p. m.	se.	.....	None	None	.....	.....	.....	.....	J. E. Bamfield, Atchison, Kans.
Near Yates Centre, Kans. j	22	Early a. m.	.....	.....	None	None	.....	.....	.....	.....	F. E. Gray, Yates Centre, Kans.
Buena Vista, Ind. k	22	6.30 p. m.	ne.	Funnel	2	Several	375 to 2,640	None	Several houses and out-buildings.	.....	J. H. Briner, Hazleton, G. T. Kimlost, Union, C. D. Courtright, Decker, Ind.
Paris, Ky. l	23	8 a. m.	s. 33° e.	.....	None	None	900 to 1,200	.....	Many houses, barns, and out-buildings.	.....	J. W. Fox, Paris, Ky.
Huntington, Miss. m	24	4 p. m.	ne.	.....	None	Many	Narrow	.....	Many houses	.....	J. A. Salter, Crawford, Miss.
Near Mount Carmel, Ill. n	24	6 p. m.	ne.	Funnel	2	Several	210 to 1,320	.....	Destroyed everything in its path.	50,000	James Pool, Mount Carmel, Ill.; W. C. Fisher, Potoka, Ind.
Near Clarksville, Ark. o	24	6.30 a. m.	e., ne.	Funnel	20	75-100	300 to 900	A large number.	Destroyed everything in its path.	150,000	E. C. Bradley, Dover, J. D. Denney, Laurel, H. S. Sewers, Alma, and J. M. Bench, Cole Hill, Ark.
Evansville, Ind. p	25	10 a. m.	ne.	Funnel	None	None	90 to 120	.....	Many houses, barns, and out-buildings.	.....	L. Stansbury and J. W. Laner, Evansville, Ind.
Chatham and Wake counties, N. C.	25	Midday	ne.	Funnel	None	2	900 to 1,200	.....	Many houses, sheds, and out-buildings.	.....	L. T. Brown, Sanford, H. L. Kimrey, Soapstone Mount, and G. W. Harmon, Kimbletown, N. C.
Near Wade's Mill, Ky.	26	Afternoon	se.	.....	None	None	Narrow	.....	Many houses and barns.	.....	C. C. Priest, Wade's Mill, Ky.
Soapstone Mount, N. C.	26	4.30 p. m.	easterly	.....	None	None	Narrow	None	Several destroyed.	.....	H. L. Kimrey, Soapstone Mount, N. C.
Fort Sill, Ind. T. q	29	8 p. m.	ne.	Funnel	None	None	7,920 to 10,560	None	Many badly damaged.	.....	Signal Service observer, Fort Sill, Ind.
Walnut Springs, Tex. r	29	9 p. m.	se.	.....	.....	.....	Narrow	.....	1 church, several houses.	.....	T. A. Etheridge, Clifton, "Morning News," Dallas, Tex.
Mossville, Tex.	29	9 p. m.	ne.	.....	None	None	.....	.....	.....	.....	R. Deming, Mossville, Tex.
Near Cleburne, Tex.	30	1.30 p. m.	se.	.....	None	Several	Narrow	None	Many	.....	Dr. T. C. Osborn, Cleburne, Tex.

a A black cloud, rapidly approaching from the northwest.

b The tornado cloud was accompanied by a whistling, roaring sound; was very black, dense, and broad, say a mile in its broadest portion, becoming two hundred yards at the point near the ground. It appeared to be about a quarter of a mile high and looked like an inverted funnel of thick, gray smoke whirling around like a great top; light, fleecy clouds encircled the upper portion of funnel.

c Large pillars of white, fleecy clouds above the main cloud, moving rapidly; they shaded off to a very dark, angry looking cloud, and were accompanied by a loud, roaring noise.

d Cloud black and very angry looking.

e Cloud very black at the point and of a dull, lead color at the top; approached with a loud, roaring noise.

f The tornado cloud consisted of from four to seven cone-shaped clouds, the two central ones being as large as all the others together; they were very black, with light, fleecy clouds encircling the top. It was accompanied by a roaring noise.

g Cloud accompanied by a dull, heavy, rumbling roar, which appeared to come from a considerable height in the air.

h Cloud very dark and approached with a loud, roaring noise.

i Cloud very dark and ragged.

j The cloud passed over the city at a considerable elevation, occasionally touching the earth.

k The cloud was very dark and black, with a greenish hue.

l A dark looking cloud, but broken up and apparently in great agitation as if disturbed by some strange influence.

m Dark, heavy cloud approached with a roaring noise.

n Cloud very black, accompanied by a roaring noise.

o Tornado originated in Indian Territory and remained high in the air until it struck the Ozark Mountains. Two miles from Ozark it separated, one part going south and the other north, the former destroying all in its path, when it rose and moved northeast; the part that went north moved three miles northeast of the town. When about five miles east of Ozark, the two reunited and began their work of destruction.

p A large, black cloud, cone-shaped, accompanied by a rumbling noise. The cloud burst over the town with the noise of a cannon, after which the wind suddenly ceased.

q A dense, black cloud formed in the northwest and remained stationary for about an hour, when a small cloud of a steel-blue color was seen to rise a little in advance of the first cloud, having a whirling motion.

r Cloud formed and remained at a considerable height while passing Mossville.

INLAND NAVIGATION.

STATE OF WATER IN RIVERS AND HARBORS.

In the following table are shown the danger-points at the various river stations and the highest and lowest depths for April, 1887, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, April, 1887.

[Expressed in feet and tenths.]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La.....	29.9	1	14.2	30	3.3	10.9
<i>Arkansas River:</i>						
Fort Smith, Ark.....	22.0	28	5.6	15, 16, 17, 18	0.4	5.2
Little Rock, Ark.....	23.0	29	3.7	19	1.9	1.8
<i>Missouri River:</i>						
Omaha, Nebr.....	18.0	1	13.9	29	7.4	6.5
Leavenworth, Kans.....	20.0	1	17.0	30	10.0	7.0
<i>Mississippi River:</i>						
Saint Paul, Minn.....	14.5	17	9.6	2, 3	5.5	4.1
La Crosse, Wis.....	24.0	19, 20, 21	11.9	3	5.8	6.1
Dubuque, Iowa.....	16.0	25, 26, 27	15.0	1	5.9	9.1
Davenport, Iowa.....	15.0	25, 29	11.5	1	4.7	6.8
Keokuk, Iowa.....	14.0	30	10.5	3	5.3	5.2
Saint Louis, Mo.....	32.0	3	79.5	17	12.9	7.6
Calto, Ill.....	40.0	30	38.7	18, 19	18.4	20.3
Memphis, Tenn.....	34.0	30	38.7	21	15.4	13.3
Vicksburg, Miss.....	41.0	1	44.6	26, 27	22.1	22.5
New Orleans, La.....	13.0	9	15.1	30	10.1	5.0
<i>Ohio River:</i>						
Pittsburg, Pa.....	22.0	30	11.5	4, 5, 7	3.0	8.5
Cincinnati, Ohio.....	50.0	25	49.5	17	12.0	37.5
Louisville, Ky.....	25.0	26	25.9	16, 17	6.2	19.7
<i>Cumberland River:</i>						
Nashville, Tenn.....	40.0	26	17.6	17	6.2	11.4
<i>Tennessee River:</i>						
Chattanooga, Tenn.....	33.0	27	21.2	21, 22	4.2	17.0
<i>Monongahela River:</i>						
Pittsburg, Pa.....	29.0	30	11.5	4, 5, 7	3.0	8.5
<i>Savannah River:</i>						
Augusta, Ga.....	32.0	25	9.4	17	6.7	2.7
<i>Sacramento River:</i>						
Sacramento, Cal.....		11	20.5	20	19.3	1.2
<i>Willamette River:</i>						
Portland, Oregon.....		3	11.5	19	8.7	2.8

Mississippi River.—Saint Paul, Minn.: the first boat of the season, the steamer "Pittsburg," from Saint Louis, arrived at this port on the 20th. On the 10th the steamer "Mary Morton" had forced her way up the river as far as Reed's Landing, but, owing to ice obstructions in Lake Pepin, was unable to proceed.

Hudson River.—Albany, N. Y.: on the 5th the ice on the river began breaking up but gorged slightly at Pleasure Island against the upper bridge. On the 6th navigation opened, the propeller of the Chenney Towing Line arriving from New York City, and the tug "Alexandria Robertson" making the trip to Troy. On the 7th, 8th, and 9th the river was filled with flowing ice; on the 10th a gorge at the mouth of the Mohawk gave way, causing the Hudson at this point to rise rapidly, and filling it with large masses of ice. On the 11th the river had risen eleven feet since 3 p. m. of the preceding day; navigation was suspended on account of the high water, all docks being submerged. At noon of the 12th the river was fifteen feet above the low-water mark of 1876; from the 12th to 17th it subsided slowly; from the 17th to 24th it rose, and on the latter date the docks were again submerged.

Red River of the North.—Saint Vincent, Minn.: about the 8th and 9th the ice on the Red River began to be sensibly affected by the warm weather, becoming porous and unsafe for travel; on the 12th the water rose above the ice. The river continued rising until the 15th, when the ice broke up and moved down in large masses. On the 20th, although the river was still filled with heavy flowing ice, the ferry-boat plying between this place and Pembina, Dak., resumed her regular trips.

Lake Erie.—Buffalo, N. Y.: navigation opened on the 17th; the steamer "Iron Chief" cleared, and the steamers "Farwell" and "Sheriff" arrived. On the 20th, 23d, and 24th heavy southwest winds again filled the harbor with ice which impeded navigation.

Lake Michigan.—Escanaba, Mich.: during the latter part of

the month the ice in Green Bay broke up but it remained solid in this harbor and Little Bay de Noquet until the 28th, on this date the steamers "Manhattan" and "Progress," the latter from Cleveland, Ohio, succeeded in forcing a passage through the ice and reaching this port. On the 30th the bay was still filled with heavy floating ice which was, however, not firm enough to prevent the arrival and departure of vessels.

Milwaukee, Wis.: the steambarge "J. W. Wescott" arrived at this port on the 26th; this was the first arrival this spring from the lower lakes.

Mackinaw City, Mich.: the high wind of the 22d and 23d broke up the ice in Mackinac Strait and forced it through into Lake Michigan; on the 24th several vessels from ports on the lower lakes passed through. Although the straits were still filled with heavy drift ice the steamers encountered but little difficulty in forcing a passage.

Frankfort, Mich.: the violent westerly gale and high waves of the 4th broke up the ice in the harbor. On the 8th the lake in this vicinity was clear of ice, and the first sailing vessel of the season, the "Minnehaha," arrived from Detroit, Mich.

Traverse City, Mich.: the ice in Grand Traverse Bay broke up and moved out on the 22d.

Lake Huron.—Port Huron, Mich.: from the 6th to the 24th the Saint Clair River and Lake Huron, at this point, were filled with large masses of floating ice; on the 25th and 26th the ice drift was light; during the remainder of the month the river was clear. On the 12th the steamer "Atlantis" pushed her way through the ice and departed for Alpena; on the 14th the steamer "Oscoda" arrived from northern ports.

Alpena, Mich.: on the 12th the steamer "Atlantis" arrived at the mouth of Thunder Bay, but was unable to force a passage through the solid ice which covered the bay. From the 12th to 18th rainy weather prevailed, weakening the ice to such an extent that the "Atlantis" succeeded in reaching this port on the latter date.

Bay Port, Mich.: the ice in Saginaw Bay broke up the 17th.

Lake Superior.—Duluth, Minn.: the high westerly winds of the 28th broke up the ice at this port and moved it half a mile from the shore. On the 29th and 30th large quantities of ice were forced into this end of the lake by easterly winds.

Lake Champlain.—Burlington, Vt.: navigation on the lake opened on the 29th; this is the latest opening, with two exceptions, April 29, 1837, and May 1, 1875, since 1816.

FLOODS.

Troy, N. Y.: the high temperature of the 10th had the effect of breaking up the ice in the streams to the north, the Mohawk, Hoosic, and other rivers; after 6 p. m. the Hudson River at this point was filled with floating ice and the water began rising rapidly, flooding cellars and basements along the river front. On the morning of the 11th the water was above the piers, but no serious damage was done. At Stillwater the flood carried away two sections of the bridge between that place and Schaghticoke.

Schenectady, Schenectady Co., N. Y.: unusually high temperature for April prevailed on the 10th, causing the ice in the Mohawk River to break up during the afternoon; the ice moved steadily during the night, and on the morning of the 11th the river was clear. In the vicinity of Canajoharie the flood and moving ice did considerable damage, breaking down a number of telegraph poles and injuring the abutments of the Palatine bridge. Travel on the New York Central Railroad, which follows the Mohawk River, was much impeded by the flood and ice of the 11th and 12th. At noon of the 12th the tracks from Fort Plain to Fonda were under water at some points to a depth of two feet. After the 12th the freshet subsided.

Binghamton, Broome Co., N. Y.: the maximum temperature of the air in this town and vicinity on the 10th ranged from 73° to 76°. The large amount of snow in the woods and fields about the headwaters of the Susquehanna and Chenango

rivers melted rapidly and on the 11th the rivers were high, with a swift current. On the 12th the town was nearly surrounded by the waters of the two rivers. Hundreds of cellars were flooded, and a number of mills and factories were compelled to cease operations.

Vevay, Switzerland Co., Ind.: on the 22d, at 1 a. m., a heavy storm of thunder, lightning, and rain set in and continued without intermission until the early morning of the 23d. The precipitation was large, 1.87 inches of rain falling during the first seven hours of the storm; it continued copious all day, an additional amount of 1.80 inches falling, making a total of 3.67 inches in twenty-six hours; the result was great destruction of crops from washing and overflows, with fences, sheds, and other light buildings carried away. On the 23d the Ohio River rose at the rate of twelve inches per hour, and in a number of places overflowed its banks. At New Albany, in Floyd county, the storm set in at 2 a. m. and was accompanied by an intense electrical disturbance and the heaviest rainfall that has oc-

curred in this part of Indiana since December, 1882. The streams were at flood height, carrying away bridges, and doing great damage to roads and farms. A great number of reports similar to the above have been received from stations in Kentucky, southern Illinois, Indiana, and Ohio, indicating that an unusually large amount of rain fell over the greater part of the Ohio Valley on the 22d and 23d. In Clermont county, Ohio, the Little Miami River overflowed its banks at noon of the 22d and did considerable damage. In Boyle county, Ky., the precipitation is stated to have been the heaviest that has occurred for years; Clark's Run, a small stream, was rapidly swollen to a flood which did much damage by washing away fences and the soil of recently plowed land.

Jeffersonville, Ind.: during the storm of the 22d a number of houses were flooded, the sewers not being large enough to carry off the water. The rainfall from 9 p. m. of the 21st to 9 p. m. of the 22d, 3.11 inches, was the heaviest since April 5th and 6th, 1883, when 3.14 inches fell in 12 h. and 45 m.

ATMOSPHERIC ELECTRICITY.

AURORAS.

The most extensively observed aurora of the month appeared on the night of the 14-15th, but it was not brilliant and exhibited no unusual characteristics. In New England clear weather prevailed, and the display was visible at stations in this district from about 8.30 to 11.30 p. m.; at 11 p. m. the light assumed the form of a faint auroral arch, with some appearance of streamers. From New England westward over the northern part of the country to the Rocky Mountains the sky was obscured by clouds, except in portions of the upper Mississippi valley and upper lake region; in the latter districts clear or fair weather prevailed, and the aurora was noted at a number of stations. From the one hundred and twelfth meridian westward to the Pacific Ocean the sky was clear or fair, but the display was observed at two stations only, Tatoosh Island and Port Angeles, Wash., where it was quite brilliant, and was visible from 11.20 p. m. until after 2 a. m. The observers describe it as consisting of an arch of yellow light, extending from 40° east to 40° west of the magnetic meridian, the western extremity being hidden by stratus clouds. At 12.15 a. m. quivering streamers extended nearly to the zenith; these were succeeded by "merry dancers," which followed each other in rapid succession from east to west. From 1.30 to 2 a. m. the light was very brilliant, illuminating the entire northern sky.

Below are given the chief features of the more important of the remaining displays of the month:

1st-2d.—A faint light was reported from Duluth, Minn., and Poplar River, Mont.; the sky over the intervening country was obscured by clouds, but clear weather prevailed in all other parts of the country, except along the Atlantic coast. At Duluth it was visible from 9.45 p. m. until after 1 a. m.; a few streamers appeared at 11.45 p. m.

10-11th.—A faint aurora was visible at Escanaba, Mich., from 8.30 p. m. until after 1 a. m., when clouds obscured it. The sky was generally cloudy in the Lake region and westward.

11-12th.—Reported from a number of stations in New England; from thence westward in the northern districts of the country cloudy weather, with rain or snow, prevailed. This display was quite brilliant at Mount Washington, N. H., where it was first noted between 10 and 11 p. m., in the form of an arch. Waves of light moved rapidly from east to west, and streamers rose from the western extremity of the arch to an altitude of 70°; the streamers were very slender but remarkably distinct, the edges being unusually well defined. The lower part of the arch was of a yellow color, gradually becoming light green on the upper side.

15-16th.—The auroral light was noted at several stations on the night of the 15-16th, through breaks in the clouds which covered the sky from Dakota eastward; at Fort Totten, Dak.,

it appeared in the form of a faint arch, and was visible from 11 p. m. to 12.30 a. m.

18th.—An aurora of moderate brilliancy was noted at stations in northern Michigan. Clear weather prevailed in the Lake region, but rain or snow in districts to the east and west. The light was visible from 9.25 to 10.20 p. m., and consisted of an arch of white light extending 10° above the horizon and from azimuth 140° to 210°. A few streamers appeared.

19-20th.—On this date a faint display was visible at Marquette, Mich., Fort Totten, Dak., Saint Vincent, Minn., and Poplar River, Mont., from 11 p. m. until after midnight; the sky was clear or fair in all districts except the upper Mississippi valley. The observer at Marquette, Mich., describes this aurora as being quite brilliant and in the form of an arch extending from azimuth 130° to 220°. The display was accompanied by "merry dancers" and streamers of various lengths, some reaching to within 15° of the zenith.

23d-24th.—This display was of moderate brilliancy but was generally obscured by the clouds which covered the sky over the northern districts. It was reported from Eastport, Me., Lyons, N. Y., Cresco, Iowa, Alpena, Mich., and Poplar River, Mont. At Alpena, Mich., it was visible from 8.30 p. m. until after midnight, and consisted of a diffused light resting on a dark segment, and extending about 35° east and west of north. At 9 p. m. faint streamers were noticed shooting up from all points of the aurora, having an apparent motion from east to west. The display reached its maximum brilliancy at 10 p. m.

25th.—Reported from Moorhead, Minn., only, although clear or fair weather prevailed over the Lakes, Missouri Valley, and upper Mississippi valley. The aurora was visible from 1 a. m. until dawn; it first appeared as a long, white arch extending from east to west across the northern horizon. At 1.30 a. m. numerous streamers appeared at its western edge.

28th.—On this date a faint auroral arch was noted at Marquette, Mich., and Duluth, Minn.; at the same time rain or snow was falling over all districts toward the east; in the north-western districts the sky was clear or fair.

THUNDER-STORMS.

Thunder-storms were reported from some part of the various states and territories on the following dates:

Alabama.—7th, 18th, 21st, 22d, 23d.

Arizona.—8th, 14th.

Arkansas.—4th, 6th, 14th, 17th, 21st, 22d, 26th, 27th, 30th.

California.—10th, 29th.

Colorado.—10th, 11th, 13th, 16th, 17th, 20th.

Connecticut.—18th, 23d, 29th.

Dakota.—1st, 8th to 11th, 13th, 28th, 29th, 30th.

Delaware.—15th, 18th, 26th.

Florida.—1st, 3d, 6th, 7th, 8th, 11th, 13th, 14th, 15th, 18th, 19th, 23d, 24th, 25th.
Georgia.—1st, 8th, 15th, 18th, 22d to 25th.
Idaho.—17th, 24th, 28th.
Illinois.—13th, 14th, 15th, 17th, 20th, 21st, 22d, 26th, 27th, 28th, 30th.
Indiana.—13th to 17th, 21st, 22d, 23d, 26th, 27th, 28th.
Indian Territory.—11th, 16th, 17th, 21st, 25th, 29th.
Iowa.—3d, 6th, 10th, 12th-14th, 17th, 21st, 22d, 26th, 27th, 30th.
Kansas.—9th to 13th, 16th, 17th, 19th to 22d, 27th, 29th, 30th.
Kentucky.—7th, 14th, 17th, 18th, 21st, 22d, 23d, 26th, 28th.
Louisiana.—8th, 17th, 22d, 23d, 24th.
Maryland.—14th, 15th, 18th.
Massachusetts.—18th, 29th.
Michigan.—3d, 4th, 8th, 9th, 10th, 12th to 15th, 22d, 27th, 28th.
Minnesota.—9th, 10th, 11th, 29th, 30th.
Mississippi.—22d.
Missouri.—16th, 21st, 22d, 25th to 28th, 30th.
Montana.—29th.
Nebraska.—3d, 10th, 11th, 21st, 29th, 30th.
Nevada.—28th.
New Hampshire.—29th.
New Jersey.—11th, 15th, 18th, 22d, 23d, 25th, 26th.
New Mexico.—8th, 12th, 15th, 16th, 24th.
New York.—9th, 10th, 13th, 15th, 21st, 23d, 27th.
North Carolina.—15th, 18th, 20th, 21st, 22d, 26th to 29th.
Ohio.—14th, 15th, 21st, 22d, 23d, 27th, 28th.
Oregon.—28th.
Pennsylvania.—14th, 15th, 27th.
South Carolina.—14th, 15th, 16th, 18th, 20th, 22d, 23d, 25th, 27th, 28th.
Tennessee.—4th, 7th, 15th, 17th, 18th, 21st, 22d, 23d, 26th, 27th, 28th.
Texas.—7th, 8th, 9th, 11th to 17th, 20th, 22d, 28th, 29th, 30th.
Vermont.—9th.
Virginia.—14th, 15th, 16th, 18th, 19th, 23d, 26th to 29th.
Washington Territory.—24th, 29th.
West Virginia.—15th, 18th, 22d, 28th, 29th.
Wisconsin.—3d, 10th, 11th, 12th, 14th, 15th, 21st, 22d, 26th, 27th, 28th, 30th.
Wyoming.—16th, 18th.

ELECTROMETER READINGS.

Observations of the value of the electrical potential of the atmosphere have been made during the month of April, 1887, at Washington City, Baltimore, Md., New Haven, Conn., Ithaca, N. Y., Boston, Mass., Columbus, Ohio, and Terre Haute, Ind. In addition to the regular series at Washington City a series of simultaneous observations were taken at the top of the Washington Monument and at the Signal Office on April 7th. The following table gives briefly the results:

Time.	Monument.	Signal Office.	Difference.	Time.	Monument.	Signal Office.	Difference.
	Volts.	Volts.	Volts.		Volts.	Volts.	Volts.
9 a. m.		18		12.06 p. m.	275	0	275
11.00 a. m.	1000	36	964	12.07 p. m.	0	6	
11.05 a. m.	1225	30	995	12.08 p. m.	1250	0	
11.10 a. m.	1150	36	1114	12.09 p. m.	0	0	
11.15 a. m.	1125	36	1089	12.10 p. m.	2000	0	
11.20 a. m.	1750	42	1708	12.11 p. m.	1125	18	1143
11.25 p. m.	1375	54	1321	12.12 p. m.	1125	0	1125
11.30 a. m.	875	42	833	12.13 p. m.	1125	0	
11.35 a. m.	1175	24	951	12.14 p. m.	0	12	
11.40 a. m.	1450	36	1414	12.15 p. m.	2500	0	
11.45 a. m.	1075	0	1075	12.16 p. m.	1000	0	1018
11.50 a. m.	1000	6	1006	12.17 p. m.	1000	6	
12.00 m.	1100	30	1130	12.18 p. m.	1100	6	906
12.01 p. m.	1200	12	1212	12.19 p. m.	800	18	818
12.02 p. m.	750	12	762	12.20 p. m.	950	0	950
12.03 p. m.	1075	12	1087	12.21 p. m.	900	12	912
12.04 p. m.	1000	12	1012	12.22 p. m.	850	0	850
12.05 p. m.	750	6		1 p. m.	900	0	900

a Very variable.

This was a cloudy day, with fresh easterly winds. At the top of the Monument sparks could be obtained, about 2 mm. in length and about thirty per minute. The most interesting fact in this series of observations is the appearance of negative values at the lower station, while positive values were obtained at the upper. This is, perhaps, due to the inductive action of the heavy layers of stratus clouds, the electrification of which induced so strong an opposite electrification on the earth surface that the equi-potential surface represented by zero extended, at times, as high as fifty feet above the ground. The collector at the lower station is, however, exposed from the window of a building, and by no means well shielded against the influence of surrounding walls and roofs. But it may be considered interesting to know that this equi-potential surface does fluctuate to such (and doubtless larger) extent.

Of the regular series of observations, light snow on the 1st was accompanied by positive values; cloudy weather on the morning of the 13th also attended with negative values; cloudy weather and light rain on the 15th, with positive values; heavy rain on the 18th, with large negative values; heavy rain on the 22d, preceded by falling positive and accompanied by high negative values; cloudy weather and rain on the 25th, with positive values; on the 28th, a light thunderstorm, accompanied with the usual fluctuations; and on the 29th, light rain, accompanied with positive values. For purposes of predictions the observations for this month are not very satisfactory, there being few examples of change in the value of the potential previous to, during, and succeeding changes in the weather. It might be noted, however, that the potential values at this season of the year are less certain in character, more unstable, and of shorter duration than during those seasons when the weather itself is more settled.

At Baltimore, Md., a continuous record for the month has been obtained by the aid of photography. A discussion of the results will be given later. For the month of March the mean tri-hourly values were determined to be as follows: Midnight, 148 volts; 3 a. m., 140 volts; 6 a. m., 157 volts; 9 a. m., 161 volts; 12 m., 153 volts; 3 p. m., 140 volts; 6 p. m., 130 volts; 9 p. m., 139 volts. There were but few negative readings, all of which, however, are excluded.

Observations were made for the first time at Terre Haute, Ind. The following abstract is from the observer's report. These observations have the personal supervision of Prof. T. C. Mendenhall. The exposure is from the third floor on the north side of the Rose Polytechnic Institute, and fairly free from influencing objects: "The collector is inside the room, 15 inches from the inner wall, and the nozzle is 6½ feet from the outside wall of the building and 42 feet above the ground. The electrometer and adjunct apparatus similar to that employed in the Physical Laboratory at Washington City."

On April 1st, high negative values prevail during light rain and sleet, falling to zero as the rain ended, and half an hour later high positive values. At 11.55 a. m., during the passage of heavy clouds, there is a change in the values of the potential, equivalent to 5,000 volts. At 11.57 light rain began, ending at 12 m., accompanied by high negative values, falling to zero as the rain ended, and becoming afterwards positive. From 12.03 p. m. until 1 p. m. the indications are very variable. The day was generally cloudy and threatening, with occasional calms and shifting winds. The values obtained at the different times are shown on the first diagram of chart vi. On April 3d a single negative value occurs among positive readings, the sky being clear overhead, but with cumulus clouds on the horizon. On April 4th, during threatening weather, negative values appear, and again on the 6th.

Positive values prevail at every observation from the 6th to the 14th, during a spell of dry, pleasant, and at times hazy, weather. Negative values occur on the afternoon of the 14th, during threatening weather, and on the 15th with presence of clouds. Rain on the 18th, changing to snow, accompanied by negative values, changing to high positive. Rain on the morning of the 20th was accompanied with negative values,

becoming positive after the ending of the rain. Very light rain on the evening of the same date was accompanied by a negative value. Threatening weather and light rain on the 21st were preceded by negative indications. The beginning of the rain was marked by high positive values, soon changing to negative and variable values. Exceedingly high values on both sides were obtained, and frequent and continued sparking noticed in the electrometer. A thunder-storm on the 22d was attended by the usual fluctuations, the deflections being too extensive and rapid, at many times, for record.

Of the observations made at New Haven, Conn., the following are noteworthy; on the 1st, snow was accompanied by positive values, continuing until the ending of the snow on the 2d. Rain on the night of the 4th was preceded in the afternoon by decreasing positive values. Positive values prevail during the spell of fine weather until April 12th. Negative and low positive values prevail on the 14th during cloudy weather. Rain on the 15th, beginning at 4.18 p. m., was preceded by low positive and negative values, five hours. On the 18th negative values were given at 8 a. m., snow beginning at 9.40 a. m. and accompanied by high positive and negative values, becoming finally positive with the continuance of the snow and a change to sleet. Rain on April 23d was accompanied with low positive and negative readings at its beginning, changing to positive; and rain on the 26th was accompanied by high negative values, changing to positive values after the rain ended. Negative readings occur on the 27th, during threatening weather; and on the 28th, during rain; becoming positive after the rain ended, and falling again to low positive in the afternoon, about an hour previous to the beginning of rain. On April 29th the influence of heavy cumulo-stratus clouds is apparent in the readings. Negative values were recorded at times, and a general instability of the potential value. Distant thunder at 1 p. m. was accompanied with negative values.

At Boston, Mass., negative values were obtained on the 1st, at 7 a. m. and 1, 7, and 11 p. m. during threatening and uncertain weather. Positive values were obtained at 11 a. m. and 3 p. m. Light snow began at 9.45 a. m. and ended at 11.50 a. m., beginning again at 3.35 p. m. and ending at 4.05 a. m. Thus positive values prevailed during the occurrence of snow. Snow began again at 2.10 a. m. on April 2d, and was accompanied by a negative value at 7 a. m. and positive values throughout the rest of the day. Light rain, ending at 8 a. m. on the 5th, was accompanied by low positive potential, increasing after the ending of the rain.

The following record of the 6th, with the observer's note, is of interest:

Time	7 a. m.	11 a. m.	1 p. m.	3 p. m.	7 p. m.	11 p. m.
Volts	+45.8	-199.9	-780.5	-106.7	+98.9	+151.1
Temperature	23° 6	33° 5	41° 6	39° 5	35° 4	33° 1
Relative humidity	99° 0	47° 0	33° 0	30° 0	38° 0	48° 0
Wind	nw.	nw.	nw.	nw.	nw.	w.
	Brisk	High	Brisk	Brisk	Brisk	Fresh
Clouds	1	1	0	0	0	0
	Cir.-cu.	Cir.	0	0	0	0
	w.	w.	0	0	0	0

NOTE.—A steady minus potential indicated by the electrometer during the morning and afternoon. With every gust of wind (nw.) the deflections of the needle increased greatly. This, and the negative potential, were undoubtedly due to the positive electrification of the building and the opposite induced charge upon the collector. Deflections were smaller during intervals of no wind.

These remarks apply equally well to April 7th, when negative values are recorded that otherwise are difficult of explanation. On April 11th negative readings at 7 a. m. precede rain, beginning 8.25 a. m., ending 8.50 a. m., with positive values during the rest of the day. On April 12th the effect of cloud-influence is apparent in the observations. On April 15th negative potentials were recorded from 10.50 a. m. until 11.05 a. m., and in the evening from 6.40 until 9.08, rain beginning at 9.35. Low values prevail on the 16th during rain, with, occasional negative readings. On the 18th snow was preceded and accompanied by abnormally high positive values, and on the 21st variable values, high positive and high nega-

tive, during showery weather. Negative values on the 23d at 7 a. m., 11 a. m., and 7 p. m., with rain beginning at 10.55 a. m., ending at 11.20 a. m., and beginning again at 8.06 p. m. On the 25th negative values at 3 and 7 p. m. precede rain at 9.50 p. m., while positive values prevail during the continuance of the rain. On April 27th a steady negative potential was indicated from 7 a. m. until 6.20 p. m., the maximum deflection occurring at 10.30 a. m., lasting until 11.20 a. m., from which time there was a steady decrease until 6.20 p. m., when zero was reached and positive values began. On April 28th negative and low positive values occur sufficiently long in advance of the rain to be of practical use.

The observations for this month at Boston, Mass., afford some very interesting and satisfactory results with regard to the value of electrometer indications in weather predictions.

The observations made at Columbus, Ohio, show that positive values prevail during fine, pleasant weather. From the 1st until the 15th no negative values are noticed. At 3 p. m. of the 15th the first negative value is recorded. Rain on the 18th is preceded at least half an hour, and accompanied, by negative values. A negative value is recorded at 3 p. m. of the 20th. On the 22d, at 8.45 a. m., distant thunder was heard, and at 9 a. m. heavy rain began and continued at intervals during the day. The values obtained were as follows: 9 a. m., 990 volts; 11 a. m., 636 volts; 1 p. m., exceeding 1,875 volts, negative; and at 3 p. m., 1,971 volts.

At Ithaca, N. Y., negative values are noticed on the 1st during calm, fair weather, and on the 4th during rain. Snow on the 5th was preceded by low and accompanied by high positive values. On the 6th and 7th negative values are noted, and apparently without relation to the weather. On the 11th negative readings during showery weather, and on the 12th and 13th negative and low positive readings, rain falling during the night. On the 15th low positive in advance of the rain, and negative readings during the rain. On the 16th negative readings all day, rain from 10.45 a. m. to 11.15 a. m. Negative readings on the 17th precede snow beginning 7.30 a. m. on the 18th, while during the snow high positive readings were recorded. On the 19th negative readings, without apparent relation to the weather, and on the 24th, 26th, and 27th negative values with the occurrence of cumulus clouds. On the 28th low positive values in advance of rain.

On chart vi is shown, in the first diagram, the variations in the potential, at Terre Haute, on a spring day marked with showers. It will be noticed that unusually high and very variable readings are obtained. In the second and third diagrams the observations for the month at New Haven and Boston are charted.

ELECTRICAL PHENOMENA.

Fort Thomas, Ariz.: the 8th was characterized by clear weather, strong southwest winds, and a remarkable display of atmospheric electricity. At times the telegraph wires carried a strong current from the batteries which in a few seconds became weaker, being balanced and completely overcome by electricity of an opposite polarity, and the wires could be worked for a few minutes by atmospheric electricity alone. At intervals violent snapping discharges occurred on the lightning arrester.

Fort Apache, Ariz.: on the afternoon of the 8th, during a gale which attained a maximum velocity of forty-two miles per hour, the atmosphere was highly charged with electricity, as indicated by the working of the telegraph line; no thunder nor lightning occurred.

Fort Grant, Ariz.: on the afternoon of the 8th a heavy westerly gale set in, maximum velocity, thirty-two miles per hour; at the same time the air was charged with electricity, which greatly interfered with the working of the telegraph. Sparks several inches long were drawn from the key.

The observer at Fort Bowie, Ariz., makes a similar report. This occurred while Arizona was under the influence of low area number vi, producing in this part of the territory high winds but no rain, and very little cloud. Near both Prescott and Fort Verde a thunder-storm, with rain and hail, occurred.

OPTICAL PHENOMENA.

HALOS.

The following are brief descriptions of the weather conditions attending or succeeding the occurrence of the most extensively observed halos of the month:

1st.—Both solar and lunar halos were reported from numerous stations in the Missouri Valley, upper Mississippi valley, and upper lake region, with lunar halos, only, in New England. They were followed on the 2d by lower pressure, and in New England by a heavy snow storm with high winds.

2d.—Lunar halos were observed at a large number, and solar halos, at a few stations in the Mississippi and Missouri valleys, Arizona, and California; they were accompanied in the valley districts by cirro-stratus clouds with haze, and followed on the 3d by rapidly falling pressure and cloudy weather.

3d-6th.—On the 3d rain or snow fell over the greater part of the northeastern quarter of the country, with clear or fair weather in all other sections; the area of cloudiness was surrounded on all sides by a strip of country in which halos appeared. They were also reported from stations in California, Arizona, and southern Texas. The 4th, 5th, and 6th were similar to the 3d, the area of cloudiness being surrounded by stations reporting halos.

7-8th.—Haze and cirro-stratus clouds partially covered the sky in the northern sections and were accompanied by solar and lunar halos with high, rising pressure. On the 8th the maximum pressure of the month in these districts occurred, and a number of stations reported halos.

9-30th.—From the 9th to 26th solar halos were noted at widely separated stations, and not generally in any district. The storm of the 27th, 28th, and 29th was preceded and followed over the central and eastern sections of the United States by solar and lunar halos which were reported from a large number of stations. On the night of April 30th and May 1st an area of heavy stratus clouds covered northern New England, the lower lake region, and the northern plateau and slope of the Rocky Mountains, in other districts light haze or fair weather prevailed, and the majority of the stations in the Mississippi Valley and eastern districts, except where the sky was entirely covered, reported lunar halos.

The phases of the moon, Washington mean time, during April, as given in "The American Ephemeris and Nautical Almanac" for 1887, are as follows: New moon, 22d, 15 h. 45.0 m.; first quarter, 30th, 5 h. 52.1 m.; full moon, 7th, 12 h. 30.8 m.; last quarter, 14th, 10 h. 55.6 m.; perigee, 6th, 18.6 h.; apogee, 19th, 9.4 h.

MIRAGE.

Mirages were observed at the following places:

California.—San Francisco, 24th.

Dakota.—Parkston, 1st, 2d, 5th, 6th, 12th, 18th, 25th; Webster, 16th, 18th, 20th, 25th.

Kansas.—Salina, 2d, 6th, 7th, 23d, 29th.

New York.—Palmyra, 12th.

North Carolina.—Reidsville, 17th.

Illinois.—Lake Forest, 2d.

MISCELLANEOUS PHENOMENA.

FOREST AND PRAIRIE FIRES.

Huron, Dak.: on the morning of the 8th prairie fires were seen toward the north and south. A steady gale from the south and southeast prevailed throughout the day, attaining for twenty minutes between 6 and 7 p. m. a velocity of forty-eight miles per hour. The observer states that during this gale the fires were driven with incredible speed, and great masses of burning grass were blown miles ahead of the main body of flame; ordinary fire breaks or guards were useless. The heat was felt two and a half miles in advance of the flames. Much property was burned, and several lives were lost. Eighteen miles west of Sioux Falls a fire started and swept over miles of prairie, burning several farm houses, with barns, stock, and machinery. Several other large areas of country in the southeastern part of Dakota were burned over during the prevalence of this gale.

Valentine, Nebr.: on the 6th, 7th, and 8th prairie fires could be seen in all directions; these fires did great damage to settlers, many of whom lost all they possessed.

Atchison, Kans.: on the 11th a prairie fire started near Nicodemus, Graham Co., and moved rapidly toward the northwest before a high wind which was blowing at the time, burning a path two and a half to seven miles in width and about sixty miles in length. It is reported that large numbers of stock of all kinds were burned, and thousands of tons of hay, corn, wheat, as well as dwelling houses and barns, were destroyed by the flames. Large areas of land in Sheridan, Gove, and other counties in northwestern Kansas, and in Furnas county, Nebr., were burned over.

Forest or prairie fires occurred also at the following places: North Platte, Nebr., prairie fires, 1st, 2d, 7th, 28th; Yankton, Dak., prairie fires, 1st, 17th to 20th, 23d, 24th, 25th; Fort Reno, Ind. T., prairie fires, 3d; Fort Supply, Ind. T., prairie fires, 4th; Concordia, Kans., prairie fires, 4th, 28th; Stateburg, S. C., forest fires in various directions, 5th, 12th; Moorhead, Minn., prairie fires, 6th, 8th, 15th to 18th, 29th; Bismarck, Dak., prairie fires, 19th, 29th; Poplar River, Mont., prairie fires, 26th, 27th; Fort Buford, Dak., 29th.

METEORS.

Meteors were reported as follows:

Yuma, Ariz., 1st; Fort Grant, Ariz., and Delavan, Wis., 18th; Willcox, Ariz., and Dover, N. J., 19th; New Haven Conn., 20th; Manatee, Fla., 12th, 17th; Sanford, Fla., 15th; Archer, Fla., 20th; Windsor, Ill., 14th, 22d; Charleston, Ill., 22d; Midway, Ky., 10th; Woodstock, Md., 13th; Cambridge, Mass., 8th; Kalamazoo, Mich., 1st, 2d, 10th; Raleigh, N. C., 24th; Stateburg, S. C., and University of Va., 11th; Rappahannock, Va., 9th; La Crosse, Wis., 21st, 25th.

MIGRATION OF BIRDS.

Geese flying northward.—Wakefield and Manhattan, Kans., 1st; Bismarck, Dak., 1st, 4th; Poplar River, Mont., 1st, 5th, 6th, 7th; Fort Meade, Dak., and Dubuque, Iowa, 2d; Moorhead, Minn., 2d, 9th; Kitty Hawk, N. C., 4th; Fall River, Mass., 5th; Albany, Oregon, 6th, 7th, 10th, 12th, 13th, 16th to 19th, 23d to 27th; Readington, N. J., and Oswego, N. Y., 7th; Embarras, Wis., 11th; East Portland, Oregon, 12th, 26th; Charleston, Ill., and Fort Assinaboine, Mont., 13th; Archer, Fla., and Mackinaw City, Mich., 14th; Saint Vincent, Minn., 14th, 19th, 20th, 25th; Traverse City, Mich., 15th; Astoria, Oregon, 16th, 18th, 19th; Hay Springs, Nebr., and Bird's Nest, Va., 18th; Linkville, Oregon, 25th, 26th, 27th; Grand Haven, Mich., and Fort Bidwell, Cal., 26th; Fort Custer, Mont., 28th; Tatoosh Island, Wash, ducks and geese flying towards the north in great numbers nearly every day of the month.

Geese flying southward.—East Portland, Oregon, 4th.

Geese flying westward.—Kalamazoo, Mich., 3d; Yuma, Ariz., 10th.

Ducks flying northward.—Moorhead, Minn., 2d; Kitty Hawk, N. C., 4th; La Crosse, Wis., 9th; Saint Vincent, Minn., 19th.

Ducks flying southward.—Grand Haven, Mich., 2d; Saint Vincent, Minn., 9th.

Cranes flying northward.—Brownville, Nebr., 1st.

POLAR BANDS.

Polar bands were reported from the following stations:

North Colebrook, Conn., 9th; Archer, Fla., 4th, 15th, 17th,

22d, 23d, 26th, 28th; Riley, Ill., 5th; Salina, Kan., 9th; Ninnescan, Kans., 30th; Moorestown, N. J., 22d; Wauseon, Ohio, 1st, 12th, 30th; Napoleon, Ohio, 1st, 5th, 30th; Mount Angel, Oregon, 14th; Memphis, Tenn., 2d; Nashville, Tenn., 16th; Wytheville, Va., 6th, 17th; Dale Enterprise, Va., 25th; Blakely, Wash., 9th; Prairie du Chien, Wis., 5th, 30th.

SAND STORMS.

San Carlos, Ariz.: about noon of the 7th a violent whirlwind passed over this station, carrying with it a column of sand and dust about two hundred feet in diameter and one thousand feet in height. The column revolved from right to left, and moved slowly from the southwest to the northeast. This was followed fifteen minutes later by a smaller but similar phenomenon.

Fort Grant, Ariz.: from 11 a. m. to 7 p. m. of the 15th a severe southeasterly gale prevailed, attaining a maximum velocity of forty miles per hour, and raising heavy clouds of sand which entirely obscured the sky, and at times rendered objects only a few yards distant invisible. Whirlwinds were numerous, and heavy sand drifts, resembling snow drifts in shape, were noticed after the storm. A number of trees along the creeks and several light buildings were prostrated. High winds, with sand storms, occurred also on the 7th and 8th.

Sand storms occurred also at the following places:

Abilene, Tex., 3d; El Dorado, Kans., 3d, 5th; Pekin, Ill., 4th; Fort McDowell, Ariz., 7th; Yuma, Ariz., 9th, 10th; Keeler, Cal., 17th, 30th.

WATER-SPOUTS.

Captain Hill, of the bark "Neptune," reports having ob-

served three large water-spouts at 1 a. m. on the 1st in N. 32° 0', W. 77° 40'. The wind at the time was blowing a fresh gale from ssw., with rain squalls and rough sea. The bark "Bristol," on the 1st, at 2 p. m., in N. 39° 50', W. 68° 0', encountered a whirlwind which lasted twenty-five minutes. The water was carried into the air as high as the topgallant yard; the vessel sustained no damage.

Capt. James Lord, of the s. s. "Advance," reports having observed two water-spouts on April 9th, 4.30 p. m., in S. 9° 46', W. 34° 40'. The spouts travelled ne. at a slow rate, and revolved with the sun, drawing water upward very rapidly. They were very narrow at the base. No change was noted in air temperature; the barometer fluctuated, and the wind was se., force 4, with almost clear weather, preceded by light rain showers.

Capt. Joseph Dove, of the s. s. "Roseville," reports having observed a dangerous water-spout April 18th, 4 p. m., in N. 39° 40', W. 55° 00', during the prevalence of a heavy nne. squall, accompanied by thunder and lightning.

Sanford, Fla.: on the 23d fresh southerly wind prevailed until 5.30 p. m., when it changed suddenly to northerly and blew for a time at the rate of thirty-six miles per hour. When the change in the wind direction occurred two water-spouts, each about thirty feet in height, formed on Lake Monroe.

SUN SPOTS.

Mr. H. D. Gowey, of North Lewisburg, Champaign Co., Ohio, reports having observed sun spots on the 19th, 21st, 23d, and 30th.

VERIFICATIONS.

INDICATIONS.

The predictions for April, 1887, were made by 1st Lieutenant H. H. C. Dunwoody, 4th Artillery, U. S. Army, Acting Signal Officer and Assistant; they were verified by 1st Lieutenant Robert Craig, 4th Artillery, U. S. Army, Acting Signal Officer and Assistant.

The detailed comparison of the tri-daily indications for April, 1887, with the telegraphic reports of the twenty-four hours for which the indications were prepared, shows the general average percentage of verifications to be 77.66. The percentages for the different elements are: Weather, 81.37; wind, 72.36; temperature, 74.36. By states, etc., the percentages are: For Maine, 71.38; New Hampshire, 70.65; Vermont, 75.00; Massachusetts, 76.85; Rhode Island, 75.99; Connecticut, 77.84; eastern New York, 79.91; western New York, 77.10; eastern Pennsylvania, 78.68; western Pennsylvania, 76.34; New Jersey, 80.63; Delaware, 81.84; Maryland, 78.58; District of Columbia, 77.47; Virginia, 77.61; North Carolina, 80.26; South Carolina, 79.17; Georgia, 81.62; eastern Florida, 80.51; western Florida, 83.20; Alabama, 81.93; Mississippi, 84.73; Louisiana, 86.34; Texas, 88.36; Arkansas, 79.30; Tennessee, 78.01; eastern Tennessee, 77.50; Kentucky, 76.34; Ohio, 77.93; West Virginia, 77.93; Indiana, 75.52; Illinois, 68.19; eastern Michigan, 78.28; western Michigan, 75.30; Wisconsin, 73.02; Minnesota, 71.51; Iowa, 73.08; Kansas, 66.81; Nebraska, 70.30; Missouri, 66.44; Colorado, 70.54; eastern Dakota, 71.08.

There were eight omissions to predict, out of 8,508, or 0.09 per cent. Of the 8,500 predictions that have been made, seven hundred and thirty-seven, or 8.67 per cent., are considered to have entirely failed; two hundred and seventy-four, or 3.22 per cent., were one-fourth verified; 1,656, or 19.48 per cent., were one-half verified; 1,068, or 12.56 per cent., were three-fourths verified; 4,765, or 56.06 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

The predictions for the Pacific coast during April, 1887, were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps, U. S. Army, Assistant, and were verified by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assist-

ant. The percentages of predictions verified are: Washington Territory, 70.31; Oregon, 63.53; northern California, 79.42; southern California, 75.85.

Below are given for the Pacific coast the percentages of indications verified for March, 1887; this data was received too late for publication in the REVIEW of that date. The predictions were made by 2d Lieutenant J. E. Maxfield, Signal Corps, U. S. Army, Assistant; they were verified by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant. The percentages for the different districts are: Washington Territory, 77.62; Oregon, 71.36; northern California, 80.86; southern California, 84.87.

CAUTIONARY SIGNALS.

Of the total number of signals ordered during April, 1887, it was practical to determine the verifications of one hundred and twenty-six; of these, one hundred and eight, or 85.71 per cent., were fully verified both as to direction and velocity. Number of signals ordered for on-shore winds, one; verified, one, or 100 per cent. Number of signals ordered for northeast winds, eight; fully verified both as to direction and velocity; eight, or 100 per cent. Number of signals ordered for northwest winds, twenty-seven; fully verified both as to direction and velocity, twenty-two, or 81.48 per cent. Number of signals ordered without regard to direction, ninety; verified, seventy-seven, or 85.55 per cent. Number of signals ordered late, *i. e.*, after the verifying velocity had begun, thirteen, or 10.32 per cent.

In addition to the above, two hundred and twenty-four signals were ordered at display stations, the verifications of which it was impracticable to determine.

In twenty-five instances winds were reported which would have justified the display of cautionary signals, but for which no signals were ordered, and in four instances winds which would have justified the display of on-shore signals, but for which no signals were ordered.

COLD-WAVE SIGNALS.

Total number of cold-wave signals ordered, the verifications

of which were determined, eighty-three; verified, seventy, or 84.34 per cent. Seven signals were ordered, the verifications of which it was impracticable to determine.

In addition to the above, in two hundred and six instances, the signals ordered from this office were repeated by the observers at the regular stations to towns in their vicinity. The verifications of these it was impracticable to determine.

LOCAL VERIFICATIONS.

The following is from the April, 1887, report of the "Minnesota Weather Service:"

Verifications of weather signals for Minnesota were 86 per cent. for weather and 78 per cent. for temperature; for eastern Dakota, 93 per cent. for weather and 90 per cent. for temperature; for northern Iowa, 83 per cent. for weather and 85 per cent. for temperature.

The following is from the "Michigan Crop Report" for April, 1887:

Weather and temperature signals are now displayed in one hundred and ten cities and towns in Michigan. The predictions of weather and temperature have been verified 78.6 per cent. for this month.

Weather signals carried on the Chicago and Grand Trunk Railway; Detroit, Grand Haven and Milwaukee Railway; and the Port Huron and Northwestern Railway have been found to supply a long-felt want, and are received with great favor by the agricultural districts through which these roads pass.

The predictions of weather and temperature have been verified as follows: Chicago and Grand Trunk Railway, 77.2 per cent.; Detroit, Grand Haven and Milwaukee Railway, 79.6 per cent.; and the Port Huron and Northwestern Railway, 83.2 per cent.

Two cold-wave signals were ordered this month, both being verified. The one of the 4th and 5th was the most prominent. The signal was ordered at 12.45 a. m. of the 4th, temperature at 62° 6, and at 7 a. m. the temperature read 35° 4, and reached the minimum, 19° 1, at the central office on the morning of the 5th, twenty-four hours after the signal was ordered displayed. The range of temperature was 40° 7 in less than eight hours from the time the temperature began to fall. Frosts were reported all over the state on the morning of the 5th, and would undoubtedly have caused much damage to agriculture if this warning had not been thus spread throughout the state, enabling all interested to protect their crops.

The "South Carolina Weather Review" of April, 1887, says:

The percentage of verification of weather and temperature predictions for the whole state was: for weather, 93.0 per cent.; for temperature, 89.8 per cent.

STATE WEATHER SERVICES.

The following extracts are republished from the reports for April, 1887, of the directors of the various state weather services:

The "Alabama Weather Service," P. H. Mell, jr., of the Agricultural and Mechanical College, Auburn, director:

The dry condition of the weather has continued through April and vegetation has suffered materially. Most of the rain reported by the observers for the month fell during the 18th, 22d, and 23d, and the earth was so dry the moisture was immediately absorbed, leaving in a few hours but little trace of the precipitation. For this state the April precipitation was 4.09 inches below the average. The temperature has been very nearly normal, and no great extremes were reported from any quarter.

The state has been remarkably free from violent storms of wind; only one, on the 22d, was reported during the month, and it was quite limited in its destructive effects. At Tusculum, on that date, a thunder-storm set in at 1 p. m. with a succession of clouds during the day, followed at 3 p. m. by a severe wind storm blowing with gale force, and demolishing fences, etc. Thermometer, 62°. Hail in great quantity, nearly covering the ground; hail-stones very large, some quite irregular in shape. Leaves stripped from the trees and torn in shreds. This storm did much damage to grape vines. A large number of window glass was destroyed. The damage from the hail is supposed to be as much as \$500 to \$800.

Summary.

Mean temperature, 64°; highest temperature, 90°, at Troy, on the 30th; lowest temperature, 24°, at Gadsden, on the 6th; range of temperature, 66°; greatest monthly range of temperature, 64°, at Gadsden; least monthly range of temperature, 36°, at Greenville; mean daily range, 23° 7; greatest daily range of temperature, 46°, at Gadsden, on the 11th; least daily range of temperature, 3°, on the 7th, at Demopolis; mean depth of rainfall, 2.20 inches; mean daily rainfall, .073 inch; greatest depth of monthly rainfall, 3.99 inches, at Carrollton; least depth of monthly rainfall, 0.95 inch, at Greenville; greatest daily local rainfall, 2.88 inches, at Carrollton, on the 22d.

Average number of days on which rain fell, 4; average number of cloudy days, 5; average number of fair days, 6; average number of clear days, 19.

Warmest day, 12th; coldest day, 6th.

Prevailing direction of wind, southwest.

The "Arkansas Weather Service," Mr. George R. Brown, of Little Rock, director:

Frosts were reported on the 1st from Fort Smith, Lead Hill, Portia, Conway, and Palarm; on the 5th at Fort Smith, Little Rock, Lead Hill, Palarm, Eureka Springs, and a general light frost on the 24th over almost the entire state as far south as Helena and Texarkana, and very cold at Mariana on the 18th and Judsonia on the 27th.

A light snow fell at Fayetteville the night of the 17th, and the temperature the morning of the 18th was 38°.

The rainfall was less than the average, the deficiency being greatest in the central and southern parts of the state, where it was 5 inches less than the average; in the northern and northeastern portions it was about 2 inches less than usual. Two cold waves passed over the state, one entering at the extreme northwest on the night of the 3d, reached the central portions by the night of the 4th, and crossed the entire state by the night of the 5th. The other continued irregularly over the state from the 23d to the 27th.

The highest reported temperatures in the state were 95°, at Dallas; 94°, at Fayetteville; 93°, at Conway and Palarm; 92°, at Brinkley and Russellville, and 91°, at Alexander and Fort Smith. The lowest were 26°, at Palarm; 27°, at Fayetteville and Lead Hill; 28°, at Eureka Springs, and 29° at Russellville.

The greatest amount of rain was at Lead Hill, 3.02; the least, at Conway, 0.10 inches.

The "Monthly Review of the Illinois Weather Service," Col. Charles F. Mills, of Springfield, director:

The noteworthy meteorological features of the month of April were the continued drought from the 1st to the 17th; the remarkable maximum temperature, 95°—the highest since observation began; the cyclonic storm of the 22d, and the unusual number of high winds reported.

Temperature.—The mean temperature of the state for April, 53°, was 1° 5 above the April normal for the past thirteen years; April, 1878, with a mean temperature of 56° 1, was the warmest, and April, 1881, 45° 3, was the coolest. The mean temperature of the northern counties, 50° 1, was 1° above the April normal; the mean of the central counties, 53°, was 0° 6 above, and of the southern counties, 56° 8, was 0° 3 above the April normal. In the southern counties reporting, excepting Madison, Saint Clair, Pope, and Alexander, the mean temperatures were below the normal; but the very marked departures above the normal in the two first-named counties caused the average departure to exceed the normal by less than one-third of a degree.

A considerable decrease in the range of the monthly mean temperature from the northern to southern extremities is noted. The lowest monthly mean reported was 44° 2 from Lake Forest, Lake Co., and the highest, 60° 9, from Benton, Franklin Co., a range of 16° 7 for the state.

The highest temperature, 95°, is noteworthy as being the highest on record for April. It was reported from Jordan's Grove, Randolph Co., on the 13th. The lowest temperature, 5°, was reported from Galena, Jo Daviess Co., on the 4th. The dates of the occurrence of maximum temperature were from the 12th to the 14th for the state, and of the minimum on the 4th and 5th in the northern and central counties, and the 1st and 5th in the southern counties, with but few exceptions.

Precipitation (inches and hundredths).—A drought prevailed from the 1st to the 16th of the month, broken by general rainfall on the 17th, that was light in the northern counties, and heavy in the central and southern counties. From the latter date to the end of the month light rains were frequent in the northern counties, moderately heavy in the central counties, and heavy in the southern counties.

The average precipitation for the state for the month, 2.52, was 0.78 below the April normal for a term of ten years. The greatest average April precipitation during that period was 4.17, occurring in 1883, and the least, 2.02, in 1879. The average for the northern counties, 1.13, was 1.81 below the April normal for ten years; for the central counties, 2.69, was 0.56 below, and for the southern counties, 3.97, was 0.13 above.

From the following table it will be seen that the average April precipitation for the state has a range of nearly one inch from the northern to southern parts of the state, a gradual increase going south:

Territory.	April.									
	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Average.
Northern counties...	3.72	2.14	4.13	1.80	4.31	3.18	2.64	3.59	2.71	1.13
Central counties.....	3.54	1.47	3.99	2.36	4.14	4.61	2.23	4.98	2.46	2.69
Southern counties...	5.20	2.46	3.24	3.31	2.81	4.73	3.57	4.67	4.26	3.97
The state.....	4.15	2.02	3.79	2.49	3.75	4.17	2.81	4.05	3.20	2.52

The area of the state receiving a monthly precipitation of from three to six inches is bounded on the north by latitude 39° 30', and on the south by 37° 20', the heavy rainfall of the 17th and 21st-22d affecting that section most.

The "Indiana Weather Service," Prof. H. A. Huston, of Purdue University, Lafayette, director:

The mean temperature was slightly below the normal, but the difference did not amount to a degree, except in one instance. The warmest day was the 18th and the coldest the 5th, the range being from 90° at Marengo, Butlerville, and Delphi to 18° at Columbia City.

The rainfall was above the average except at Logansport, Lafayette, and Worthington. The greatest excess was at Vevay, where it was 3.67 inches, and Blue Lick, where it was 2.70 inches above the normal. A heavy snow storm passed over the northern and central portions of the state on the 18th, accompanied by very heavy rain in the southern portion. Remarkably heavy rain fell on the 22d in the central and southern counties, 6.77 inches being reported at Marengo, 3.67 inches at Vevay, and 3.36 at Blue Lick. At Vevay the total rainfall during the storm was 4.35 inches in thirty-two hours. The observer at Princeton reports that during this storm a tornado passed over the northern part of Gibson county, which did considerable damage, while the observer at Mount Vernon reports high winds that unroofed buildings and did other damage, and that the heavy rain caused the Ohio to overflow its banks in that neighborhood. The observer at Blue Lick reports the rainfall of the 22d the heaviest of which there is any record.

The observer at Angola reports that in his neighborhood wheat is suffering from lack of rain, and that the dry, hot weather of the early part of the month killed a great deal that had been partially dragged from the ground by the frost.

The "Kansas Weather Service," Mr. J. T. Lovewell, Topeka, director:

The mean temperature has ranged above the average for April throughout the state. The precipitation has exceeded the average for April in the western counties, while in the middle and eastern counties it has been deficient, except in Douglas county, where it 0.14 inch above. Rain or snow, in measurable quantities, fell twelve days; the heaviest falls occurred on the 12th in the western counties, and on the 17th in the central and eastern counties.

In the vicinity of Independence chinch bugs were unusually numerous, especially on the 2d, 6th, 7th, and 28th, and did serious damage to wheat, oats, etc.

The "Michigan Crop Report" (the state weather service is in charge of N. B. Conger, Sergeant, Signal Corps, at Lansing):

Temperature.—The temperature for April is only 0° 2 below the normal, as obtained from a series of readings extending from five to nineteen years. The mean for central and southern portions is 1° 3 below the normal. The range of temperature has been above the average, the absolute range being 84°, but on the whole the daily mean has been above freezing, and although frosts have been reported on nearly every day of the month in different portions of the state, yet no material damage has resulted from this range.

Precipitation.—The precipitation for this month is 0.96 inches below the normal for the state. While the northern portion is above the normal the central and southern portions are considerably below the usual precipitation for this month, the southwestern part receiving the lightest fall.

The snowfall has been light except on the upper peninsula where very heavy snow fell on the 3d and 4th. The snow that fell melted rapidly and did not remain on the ground over twenty-four hours at any time in the southern portions. Snow is reported on the ground at Keweenaw Point only. The snowfall for the month on Keweenaw Point is reported from Central Mine as 54 inches, this is estimated. For the lower peninsula the snowfall for the month, as based on reports received from thirteen stations, has been from 0.5 to 3.3 inches.

Summary.

Mean monthly temperature, 42° 8; highest temperature, 82°, on the 12th, at Athens; 13th at Benton Harbor and Hudson; lowest temperature, —2°, on the 4th, at Grayling; monthly range of temperature, 84°; greatest range of temperature, 80° 5, at Grayling; least range of temperature, 41° 2, at Central Mine.

Average precipitation, 1.38 inches; average number of clear days, 7.8; average number of fair days, 13.8; average number of cloudy days, 8.4; average number of rainy days, 8.9.

Prevailing direction of wind, southwest; maximum velocity of wind and direction, forty-eight miles, southwest, at Port Huron.

The "Minnesota Weather Service," Prof. Wm. W. Payne, Carleton College, Northfield, director:

The month was notable for heavy gales of wind, a temperature slightly above the normal, and severe thunder-storms. In southern Minnesota seeding of small grain was generally finished at the close of the month, although delayed a few days by the heavy rains. Vegetation which had appeared above ground received a severe check from the cold weather of the 25th and 26th. Seeding was also well advanced in the northern counties; it commenced at Park Rapids on the 8th. In many districts plowing for corn has begun.

Temperature.—The mean, as deduced from the reports of the stations of the Minnesota Weather Service, is 44° 1, which is 3° 4 below that of the corresponding month of 1886, and 1° 5 above that of 1885. This is slightly above the normal, except in the northeastern portion of the state. At Duluth the mean was 1° 2 below the average of the corresponding month for seventeen years, while at Saint Paul it was 6° 7 above; Saint Vincent, 2° 3 above; Moorhead, 1° 4 above, and La Crosse, 0° 6 above. But one decided cold wave passed over the state, and that was on the 4th and 5th; the lowest temperature for

the month was 3° 6 below zero, and occurred at Saint Vincent on the former date. On the 25th and 26th there was a slight cold wave in which the temperature fell below freezing. The periods of highest temperature were mainly from the 8th to 10th, 29th, and 30th. In the northeastern portion of the state the maximum for the month occurred during the former period, while elsewhere it occurred on the 30th, when the temperature was abnormally high; the highest reported was 88°, at Sherburne and Morris, on the 30th. The monthly range of temperature for the state was 91° 6, which is 6° greater than for the same month of 1886, and 16° greater than in 1885. The greatest ranges were reported from the Red River Valley; at Saint Vincent it was 87° 1, and Grand Forks, 84° 0; the least ranges were Saint Cloud, 66° 0; Red Wing, 67° 0, and La Crosse, 67° 6.

Precipitation (in inches).—The average for the state was 2.23, which is 1.43 less than that for the same month last year. It was rather unevenly distributed, as there was an excess of 0.89 at Saint Paul and 0.21 at Saint Vincent; at Duluth there was a deficiency of 0.63, while at La Crosse it was about normal. The periods of general precipitation were from the 2d to 4th, inclusive, 11th to 14th, 22d to 24th, 27th and 28th. The greatest daily amount fell during the prevalence of thunder-storms in the second of these periods in the northern and western portions of the state; elsewhere the greatest amount fell during the third period. Lunar halos were generally observed before all of these storms, excepting that from the 22d to 24th. Occasional snow fell during the early portion of the month, but rapidly disappeared from the high temperature which followed. The greatest monthly rainfalls reported were Rolling Green, 4.10; Rochester, 3.41; Delano, 3.23.

The "Mississippi Weather Service," Prof. R. B. Fulton, of the University of Mississippi, Oxford, director:

Reports from fifteen different sections show that there has been a great deficiency of rainfall over the state during the past month, which has retarded the crops to some extent, although the weather has been very favorable for preparing the ground. Corn and cotton are fairly advanced in most sections, and the crop prospects are ten per cent. better in the southwestern portion of the state than they were this time last year. Fruit has been very much injured by frost in the northern part of the state; season advanced.

Mean temperature, 66°; highest, 93°, on the 30th, at Greenville and Waynesborough; lowest, 32°, on the 5th, at Batesville; range of temperature, 61°.

Mean depth of rainfall, 1.82 inches; greatest rainfall, 3.35 inches, at Starkville; least rainfall, 0.95 inch, at Biloxi; average number of days rain fell, 4.5; rainy days, 1st, 3d, 4th, 7th, 8th, 17th, 18th, 21st, 22d, 23d, 24th, 25th, 28th. The rainfall at Vicksburg was 6.9 below the average; at Artonish Plantation there was less rainfall than in any April for the last ten years. Total rainfall for the month, 1.52 inches; for this month last year, 8.03 inches. High wind and terrific thunder, lightning, and rain at Palo Alto on the 22d.

A destructive hail storm occurred at Rolling Fork and Yazoo City on the 21st, doing much damage to growing crops.

The "Missouri Weather Service," Prof. Francis E. Nipher, of Washington University, Saint Louis, director:

The mean temperature for the past month has been 1° 7 above the average, or 57° 9, a common April temperature for Saint Louis. The highest temperature was 86° 5 on the 13th, which is the highest April temperature observed for several years. The lowest was 33° 0, and was observed on the 4th.

The rainfall at the central station was 1.80 inches in excess of the normal, which is 3.70 inches. No rain fell during the first half of the month, the weather being generally clear. A large amount of rain fell on the 16th, 17th, and 18th, over three inches falling in about thirty-six hours. Another fall of 1.61 inches occurred on the 22d. A quantity of snow fell on the morning of the 18th, lasting about three hours.

The highest temperatures reported from the state are, 90° from Miami and Springfield; 89° from Louisiana; 88° from Oregon, Sedalia, and Steelville; and 87° 5 from Fayette. The lowest temperatures were, 19° 5 from Fayette; 20° from Ironton; 22° from Kirksville; 24° from Louisiana, Sedalia, and Troy; and 25° at Oregon and Hustonia. None of the low temperatures reported from the state are above the freezing point.

The greatest amount of rain fell in the vicinity of Saint Louis, Troy reporting the greatest, it being over six inches; the next highest fall occurred at the central station. In the central part of the state the fall was from three to four inches, diminishing to less than one inch in the northern part. In the southern part the fall was from two to three inches.

The "Nebraska Weather Service," Prof. Goodwin D. Swezey, of Doane College, Crete, director:

The abruptness with which winter passed away a year ago and summer began has again been repeated; this time, however, being nearly a month in advance of last season. Last year a cold snowy March was followed by a normal April; this year a normal March has been followed by a warm April—in both cases the month of April has been dry; this April has been the driest but one for ten years, and the warmest except two.

Precipitation.—The rainfall for the month has varied from less than one inch in the northeastern counties to a little over four inches in the central part of the state, reaching its maximum in the northern part of Buffalo county. The average for the entire state is a little over two inches; the greater part of it fell during the storm which moved northward from Texas on the 12th and 13th. The number of days on which some rain fell has, however, been up to the normal for April.

Temperature.—The mean temperature for the month has been 53° 5 against

an average of 50°.8 for past Aprils. The noon temperature has in like manner averaged about 3° above the normal. The highest temperature of the month, 98°, was exceeded only in 1883, when it was 95°. The lowest for the month, 13.6°, was exceeded only in 1879, and also in 1881, when it fell to 6°. It has therefore been a month of extremes in temperature.

The "New England Meteorological Society," Prof. Wm. H. Niles, of the Institute of Technology, Boston, Massachusetts, president:

Reports for the month were received from one hundred and fifty observers. The average temperature for the month is decidedly below the normal, all stations of ten or more years' record, twenty-five in number, having a lower mean than usual, while some of the northern averages are 3° or 4° too low. The precipitation is also generally in excess of the normal, but in this case the most marked feature of the month was the excessive fall of snow. The past winter has been, as a whole, characterized by unusual snow.

Thunder-storms.—Lightning was reported from several stations in Connecticut, Rhode Island, and southeastern Massachusetts during the snow storm on the evening of the 18th, generally without thunder. Thunder was heard at a few points on the 24th and 28th. The 29th brought summer-like thunder-storms in the afternoon to southern New England. At Cambridge the morning had been fair with clouds drifting from the northwest, and by noon large cumulus masses appeared in the south and west; a cool, east breeze had sprung up a little earlier, and in the afternoon became a well-developed "sea-breeze," or chilly, east wind, bearing fog, in which the storm clouds were soon hidden. Hail fell in the shower of this storm, and lightning struck in Lunenburg, Mass. This storm seems to have been associated with the central passage of the last cyclone of the month over southern New England.

Sea breeze.—The change of seasons and the approach of summer are marked by the appearance of the sea breeze along the coast, as well as by the fewer and more moderate barometric oscillations and the more regular diurnal variations of temperature and the increase in the number of thunder-storms. As the attention of some of the society's observers will be especially directed to the phenomena of the sea breeze during the coming summer, the following notes are presented concerning its occurrence on April 21st and 24th:

On the 21st the sky was clear; the atmospheric pressure was about normal and of generally uniform distribution over the eastern third of the United States; and the winds were light. At our interior stations the range of temperature from the morning minimum to the noon maximum was large, and the noon was mild or warm; thus, the maximum was 66° at Milford, 60° at Framingham, 67° at Lake Cochituate, 62° at Concord, Mass. At Brattleborough, Vt., a thermograph record showed a rise from 27° at 5 h. 40 m. to 61° between 13 h. and 14 h., falling again to 32° on the early morning of the 24th. But at our coast stations a cool breeze came in from the sea and kept the temperature below 60°; the maximum was 54° at Boston, 53° at Lynn, and 57° at Newburyport; at Cambridge a thermograph recorded a rise from 35° at 5 h. 15 m. to 54° at 11 h. 30 m., when the easterly sea breeze arrived and prevented a warming of more than 1° or 2° through the afternoon till the evening fall of temperature followed the moderate maximum of 55° at 17 h. 15 m. At Chestnut Hill the thermograph curve rose from 29° at 6 h. to a maximum of 58° between 14 h. and 15 h., when a gradual fall began. From this it appears that the breeze was limited to a narrow belt along the coast, and that it made its way inland rather slowly.

On the 24th there was a light west or northwest wind in the morning and, except immediately along the shore, the sea breeze did not appear till late in the afternoon, so that the records of maximum thermometers failed to detect it. The inland maxima were 60° at Milford, 63° at Framingham, 68° at Lake Cochituate, 66° at Concord, Mass., and near the sea shore, 63° at Chestnut Hill, 63° at Cambridge, 64° at Boston, 59° at Lynn. At Cambridge the temperature began to fall slowly at 15 h. 40 m., and decreased rapidly after 16 h. 25 m., when the sea breeze was distinctly felt; at Chestnut Hill the first cooling began at 16 h. 10 m., and between 17 h. 35 m. and 18 h. the temperature fell from 59° to 50°, showing as before the gradual inland progression of the breeze.

The "New Jersey Weather Service," Prof. George H. Cook, of the Agricultural College, New Brunswick, director:

"April borrows three days from March and they are ill," says the proverb. This year it was a beggar from all the months in the calendar. The month opened with a regular winter snow storm, and for a day or two we were shivering with cold and ankle-deep in snow and slush, the result of a storm-centre moving along the coast from the Gulf. This was followed by high winds and a "cold wave" that gave us our minimum temperature for the month, on the 5th and 6th. The "cold snap," however, was of short duration, and by the 10th the wind had backed to the south under the influence of a storm-centre passing over the Lakes, and winter clothing became very uncomfortable. The range of temperature on the first twelve days of the month was great, running from the twenties, on the 5th and 6th, to the eighties, on the 10th and 11th, when the maximum occurred. The month as a whole could not be called cold, but it was unlike the April of last year or the year before.

The mean temperature of the state for the month, as compared with normals determined from past records at twelve stations, was found to be nine-tenths of a degree below the mean.

The rainfall for April was generally below the normal. Twelve stations show an average deficiency of ninety-four hundredths of an inch.

Four thunder-storms during the month were reported. The first on the 10th at New York City and Union. An area of low pressure on this date prevailed

on the Lakes. The second, on the 18th, was quite generally observed, and hail fell at most stations. This may be attributed to the approach of a low barometer on our southern border from Virginia. It struck the Gulf Stream about midnight of the 18th. The third, on the 23d, resulted from quite a low barometer (29.10) passing from Arkansas by way of the Lakes to Canada on that date. The fourth, reported at three stations, Beverly, Clayton, and Egg Harbor City, on the 26th, was no doubt due to the disturbances caused by a remarkably rapid movement along our coast of a storm-centre which affected our weather conditions on the 26th and 27th.

Twenty-eight stations report rain or snow to have fallen on an average of seven days out of the thirty.

Fifteen stations report an average of twelve days on which the cloudiness was equal to or exceeded eight on a scale running from zero to ten. Atlantic City, Bordentown, New York, South Orange, and Union enjoyed the most sunshine.

The "North Carolina Weather Service," Dr. Charles W. Dabney, jr., of Raleigh, director:

The first thirteen days of the month were remarkable for a general absence of rain followed by a series of thunder-storms commencing on the 15th, and generally distributed throughout the state and adjacent territory. These storms continued at intervals of three or four days until the end of the month; at many points hail remarkable for size and quantity fell. Except at Tarborough, where a few houses were damaged by wind and lightning, no serious casualties can be traced to these storms.

Summary.

Temperature.—Mean temperature of the month, 57°.1; normal mean for April, 57°.5; highest temperature, 93°.0, on the 12th, at Maxton; lowest temperature, 24°.0, on the 6th, at Marion; average morning temperature, 48°.4; average afternoon temperature, 67°.8; average night temperature, 55°.9; mean of maximum temperature, 86°.3; mean of minimum temperature, 30°.1; greatest daily range, 52°.0, at Maxton, on the 11th; least daily range, 2°.1, at Raleigh, on the 1st; greatest monthly range, 65°.0, at Davidson College, Marion, and Maxton; least monthly range, 38°.9, at Hatteras.

Precipitation (inches).—Average for the state, 2.87; normal average for April, 4.51; greatest monthly rainfall, 4.64, at Maxton; greatest daily rainfall, 2.80, at Lenoir, on the 22d; least monthly rainfall, 1.85, at Wake Forest; heavy rainfalls, exceeding one inch, occurred on the 1st at Hatteras and Wilmington; on the 22d at Salem and Lenoir; on the 23d at Marion; on the 25th at Raleigh, Maxton, Chapel Hill, Salem, and Reidsville.

Record of sunshine at Experiment Farm, two miles west of Raleigh, N. C.

Date.	Number of hours of possible sunshine.	Number of hours recorded by instrument.	Degree of intensity.	Time (75th meridian) of day during sunshine.	Possible sunshine recorded.	Character of weather.
1887.						
April 1	h. m.	h. m.			p. ct.	
2	12 40	0 0	.....	Obscured.....	0	Snow.
3	12 41	9 0	Bright.....	5.45 a. m. to 5.45 p. m....	71	Clear.
4	12 44	8 45	.....do.....	5.45 a. m. to 5.30 p. m....	67	Clear and hazy.
5	12 46	8 45	Very bright.....	8.15 a. m. to 5 p. m....	67	Clear.
6	12 49	9 0	.....do.....	5.45 a. m. to 5.45 p. m....	70	Do.
7	12 51	8 30	.....do.....	8.30 a. m. to 5 p. m....	66	Do.
8	12 54	8 0	.....do.....	10 a. m. to 6 p. m....	62	Fair.
9	12 57	8 45	Bright.....	9.15 a. m. to 6 p. m....	68	Clear and hazy.
10	13 1	9 0	Very bright.....	8.30 a. m. to 5.30 p. m....	69	Do.
11	13 3	9 15	.....do.....	8.30 a. m. to 5.45 p. m....	71	Do.
12	13 8	9 45	.....do.....	8.15 a. m. to 6 p. m....	74	Do.
13	13 11	6 15	Very faint.....	8.30 a. m. to 5.45 p. m....	70	Do.
14	13 13	0 0	.....do.....	9.15 a. m. to 4.30 p. m....	47	Do.
15	13 16	2 30	Very faint.....	Obscured.....	0	Cloudy.
16	13 18	9 15	Very bright.....	2.15 p. m. to 2.45 p. m....	19	Cloudy and hazy.
17	13 21	4 30	Faint.....	4 p. m. to 6 p. m....	19	hazy.
18	13 23	6 0	.....do.....	9 a. m. to 6.15 p. m....	70	Clear and hazy.
19	13 26	10 0	Very bright.....	8.15 a. m. to 12.45 p. m....	34	Fair and rain.
20	13 28	3 0	Very faint.....	9.30 a. m. to 11.45 a. m....	45	Do.
21	13 31	9 15	Very bright.....	2.45 p. m. to 6.30 p. m....	74	Clear.
22	13 33	3 30	Very faint.....	8.15 a. m. to 6.15 p. m....	22	Fair.
23	13 39	6 45	.....do.....	8.15 a. m. to 11.15 a. m....	68	Clear.
24	13 38	9 30	Faint.....	8.15 a. m. to 5.30 p. m....	26	Fair and rain.
25	13 41	0 0	.....do.....	2 p. m. to 5.30 p. m....	50	Cloudy.
26	13 43	10 15	Faint.....	9.45 a. m. to 4.30 p. m....	70	Fair.
27	13 46	8 45	Bright.....	8.45 a. m. to 6.15 p. m....	0	Cloudy and rain.
28	13 48	4 45	Faint.....	Obscured.....	0	Clear.
29	13 50	9 45	Bright.....	8.15 a. m. to 6 p. m....	75	Fair and rain.
30	13 52	10 0	Very bright.....	9.15 a. m. to 6 p. m....	64	Cloudy & rain.
Average..	13 16	7 4		Various intervals.....	34	Cloudy & rain.
				8.15 a. m. to 6 p. m....	70	Clear and rain.
				8 a. m. to 6 p. m....	72	Clear.
					53.2	

The "Ohio Meteorological Bureau," Prof. B. F. Thomas, of the Ohio State University, Columbus, president:

Generally fair weather prevailed throughout the state until the 14th, with light local rains on the 4th and 7th, and scattering showers on the 3d and 5th. During this interval the temperature steadily rose, except on the 5th, when a cold wave was recorded.

Local rains on the 14th were followed by a general storm on the 15th. The latter was accompanied in many places by light winds, and yielded tornadoes in the southeastern part of the state. From the 16th to the 30th generally

stormy weather prevailed, heavy rains occurring on the 17th and 18th, on the 22d and 23d, and on the 28th, with local rains on all other days between the dates given. The storm of the 15th was followed by a fall of 16° to 21° in temperature throughout the state.

The mean temperature was 49°.8, 0°.7 above the average, and 0°.48 below the mean for the state. The mean temperature for the northern section shows the influence of the Lakes, the figure being 46°.8, as against 50°.1, and 51°.8 for the middle and southern sections, respectively. The mean daily range of temperature was rather high, being 24°.5, 2°.7 above the average.

The mean rainfall was 3.83 inches, 0.9 inch above the average and 0.24 above the mean. The average depth for the northwestern section was 2.35 inches, for the middle section 3.56, and for the southern section 5.81. The greatest rainfall was 8.28 inches at Georgetown, the least, 1.13, at Oberlin.

Mean temperature, 49°.8; highest temperature, 90°.0, on the 12th and 13th, at Pomeroy; lowest temperature, 10°.0, on the 19th, at Findlay; range of temperature, 80°.0; mean daily range of temperature, 24°.5; greatest daily range of temperature, 57°.0, on the 11th, at Findlay; least daily range of temperature, 1°.0, on the 16th, at Wooster.

Average number of clear days, 10.2; average number of fair days, 12.9; average number of cloudy days, 6.9; average number of days on which rain fell, 9.4. Greatest number of days on which rain fell, 18, at Ellsworth; least number of days on which rain fell, 5, at New Bremen. Mean monthly rainfall, 3.83 inches; average daily rainfall, 0.128 inch.

Prevailing direction of wind, southwest.

The "South Carolina Weather Service," Hon. A. P. Butler, Commissioner of Agriculture for South Carolina, director:

The mean temperature of the month was slightly below the normal; while there were several warm days, notably the 11th, 12th, and 13th (when the maximum temperature ranged from 85° to 94°) the nights and mornings were generally cool. At Charleston the mean temperature was 62°.6, or 1°.7 below the mean of the last sixteen years.

The rainfall was also below the average, and was rather unevenly distributed, the central counties and the immediate coast districts receiving the greatest amounts. At Charleston the total precipitation was 3.53 inches, or 0.92 inch less than the average of the last sixteen years.

Heavy frost, causing some damage to fruit and vegetables, occurred throughout the state on the 2d. Frost also occurred in the upper and middle counties on the 1st, 3d, 6th, 9th, and 26th, and in the upper counties only on the 5th, 10th, 11th, 20th, 21st, 25th, 27th, and 30th.

Summary.

Mean temperature, 62°.3; highest temperature, 94°, at Winnsborough, and at Bennettsville, on the 12th; lowest temperature, 28°, at Winnsborough, on the 2d, and at Spartanburg, on the 6th; range of temperature, 66°; greatest daily range of temperature, 45°, at Brewer Mines, on the 11th; least daily range of temperature, 2°, at Stateburg on the 1st.

Mean depth of rainfall, 2.09 inches; greatest monthly rainfall, 4.47 inches, at Bennettsville, Marlborough Co.; least monthly rainfall, 0.79 inch, at Holland's Store, Anderson Co.; greatest daily rainfall, 1.90 inches, at Charleston, on the 1st; date of heaviest general rainfall throughout the state, 25th.

Rainfall exceeding one inch was reported as follows: Belfast, 1.73 inches, on the 15th; Bennettsville, 1.07 inches, on the 20th; Belfast, 1.37 inches;

Bennettsville, 1.10; Hampton 1.10, on the 25th. Least daily rainfall, inappreciable, at several stations, on the 1st. Average number of rainy days, 5.4.

The "Tennessee State Board of Health Bulletin," under the direction of J. D. Plunkett, M. D., President of the State Board of Health (the weather report is prepared by H. C. Bate, Director of the State Meteorological Service):

The principal features for April were the high winds which prevailed at intervals during the month, severe thunder-storms, and the very small amount of rainfall during the first part of the month.

The mean temperature was 59°.13, slightly above the mean of the month for the past five years. The highest recorded was 93°, on the 8th, and was the highest reported in April during the past five years. The lowest was 21°, on the 5th, and was very near the mean minimum for the period above mentioned.

The mean precipitation was 2.86 inches, the least for April during the past five years, except in 1885, when the mean was 2.75 inches, much below the normal for April. The amount was greatest in the eastern division, which received an average of nearly four inches; the middle division receiving an average of nearly two and a half inches, and the western division but little over two inches.

The rainfall was heaviest in the extreme northeastern portion of the state; the greatest being 5.76 inches, reported at Rogersville. The day of the greatest rainfall was the 22d, when the fall was very heavy in the eastern division, particularly in the southwestern portion; Parksville reporting 2.47 inches, and Chattanooga 2.36 inches, the greatest local daily falls reported. Most of the rains, however, were light, and only a few were general, notably on the 4th, 7th, 17th, 18th, 22d, and 27th. From the 17th to the 28th, inclusive, rains were frequent, but mostly light and local. There were twelve days on which no rain was reported. There was no snowfall reported during the month.

There were two cold-wave warnings received and distributed: 3d-5th and 23d-24th; the predictions of both being fully verified.

Dews were reported on about ten days during the month. Although dry during the early part of the month, the frequent showers during the latter portion had a very beneficial effect on vegetation, which advanced rapidly toward perfection.

Summary.

Mean temperature, 59°.13; highest temperature, 93°, on the 8th, at Dyersburg; lowest temperature, 21°, on the 5th, at Andersonville; range of temperature, 72°; monthly mean range of temperature, 56°; greatest monthly range of temperature, 66°, at Andersonville and Hohenwald; least monthly range of temperature, 44°, at Covington; mean daily range of temperature, 21°.6; greatest daily range of temperature, 44°, on the 2d, at Hohenwald; least daily range of temperature, 3°, on the 17th, at Rogersville, on the 18th, at Covington, and on the 27th, at Florence Station and Vernon; mean of maximum temperatures, 87°.13; mean of minimum temperatures, 30°.83.

Mean depth of rainfall, 2.86 inches; mean daily rainfall, 0.095 inch; day of greatest rainfall, 22d.

Average number of days on which rain or snow fell, 7.3; average number of clear days, 16.8; average number of fair days, 8.1; average number of cloudy days, 5.1.

Days without rainfall, 1st, 2d, 3d, 5th, 6th, 9th to 14th, 30th.

Warmest day, 13th; coldest days, 1st and 15th.

Prevailing wind, southwest.

NOTES AND EXTRACTS.

RAIN FREQUENCY AND WIND ROSE FOR APRIL.

[Prepared by 1st Lieut. H. H. C. DUNWOODY, 4th Artillery, Acting Signal Officer and Asst.]

Chart number vii, for April, shows the relative frequency of rain at the principal stations, the reduced scale of the chart rendering it impossible to represent diagrams from all stations, and therefore only stations were selected which would indicate the general character of rain-winds for each district. The original data from which these charts were computed consist of the number of rains preceded by winds from the eight points of the compass for which wind is reported, and by calms, the record covering the entire time of Signal Service observations. To illustrate the manner of constructing the diagrams for each station, the process followed is given for Lynchburg Va.; at this station during April for a period of fifteen years rain was preceded by winds from the several directions, and by calms, as follows:

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
Number of times rain was preceded by winds	3	38	12	5	33	21	10	11	20
Normal for April, based on fifteen years' data	0.2	2.5	0.8	0.3	2.1	1.4	0.7	0.7	1.3

The normal values, as given in the above table, for April were laid off on lines, drawn from the station as a centre, indicating the eight directions, the scale being one-fourth of an inch for one rain. The extremities of the lines thus laid off were then connected by right lines, thus forming the diagram for each station. The normal obtained for winds preceded by calms is represented by a circle, the radius of which is determined by the number of rains

preceded by calms—one rain being equal to one-fourth of an inch. The scale used in the construction of the diagram is limited, owing to the reduced scale of the map. It should be remembered that these diagrams do not represent directly the actual amount of rainfall at any station, but they show the frequency of rains occurring at any station, and therefore the dimensions indicate indirectly the amount of the rainfall, as will be seen on examining the diagrams on the chart showing the regions of greatest and least rainfall. In the eastern portion of the United States the greatest number of rains are preceded by winds in the southeast quadrant. Some exceptions to this rule, probably due to local cause, will be observed in the Lake region. At several of the Rocky Mountain stations the greatest number of rains are preceded by northerly winds, while the wind chart shows that the prevailing winds in this region are southerly. Over the plateau regions and on the Pacific coast the rain-winds are southerly—generally from south to west.

Chart number viii shows the relative frequency of winds at the several stations of the Signal Service for the month of April from the opening of observation in 1886. The diagrams are constructed in a manner similar to that used in the construction of those on chart number vii, except that the scale used was one-fortieth of an inch for one wind. For example, the data for Lynchburg, Va., during April for a period of fifteen years are as follows:

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
Number of times the wind blew	35	224	95	57	183	189	141	195	233
Normal based on fifteen years' data	2.3	14.9	6.3	3.8	12.2	12.6	9.4	13.0	15.5

The rain and dry wind charts and data relative thereto previously issued by the Signal Service were incomplete, as they generally represented only quadrants, each quadrant being determined by the greatest or least number of rains occurring in each during the time covered by the observations. This method of representing the rain-winds was incomplete, as winds blowing from one-half of the circle are, of necessity, neglected, and I have, therefore, prepared a series of charts, one for each month, which indicate for each station the frequency of rain from any direction for the month, and also the relative frequency of rain from the several directions of wind observed.

Charts number vii and viii were prepared for use in the Indications Room, where a graphic representation of data is necessary, and it is believed that they will be found of value in the preparation of the current weather predictions of the service.

DROUGHTS IN KANSAS AND TEXAS AND SECULAR VARIATION IN RAINFALL.

[Prepared by Junior Prof. H. A. HAZEN, Signal Service.]

From month to month for more than a year reports have come in of a great lack of rain and consequent drought in Kansas and Texas. In some instances fears have been expressed lest there has been entered upon a period of more or less permanent diminution in rainfall for this region. A careful investigation of this question was ordered by the Chief Signal Officer of the Army, and has resulted as follows:

The subject has already received attention at the hands of C. A. Schott, who decided in 1876 that up to that time there had been a slow and steady increase of precipitation since the earliest authentic records, which go back to about 1837. He also thought that probably the maximum or turning point had been reached and that there would be some diminution from that time on.

In 1883 an investigation of this question by the present writer showed a diminution of precipitation in 1879, but a marked increase for the three succeeding years. In the fifth biennial report of the Kansas State Board of Agriculture, p. 176, there is a paper entitled "Studies of rainfall in Kansas, as affecting climate," in which the writer, after a discussion of observations at Fort Leavenworth since 1837, and at Lawrence and Manhattan for shorter periods, says: "Extremes follow each other in regular sequence. We have had no more than two or three dry or wet years in succession. * * * We may fairly claim that Kansas climate is becoming more and more favorable. We may expect in the future, as in the past, wet seasons and dry seasons. We find often that these alternate year by year, and if the change is not annual, we have two, three, or four years of excessive rains followed by an equal period when the rainfall is below the average." A writer in the Coast Review thinks that a more or less severe drought occurs every seven years in the Missouri Valley. He notes a severe drought in 1860, a mild one in 1867, a severe one in 1874, and one less severe in 1881. A comparison of the precipitation for these years with the average for all the years shows that it was less. We may conclude that, in general, a marked deficiency in precipitation in any year has a tendency to drought, though this is varied largely by the distribution of rain and the temperature. A less fall in winter does not affect the crops if an average amount falls during the growing season.

On a comparison of the rainfall during the growing season of 1886, for Kansas and Texas, we find a marked deficiency. The rainfall for this year shows the following deficiencies: Omaha, —18 inches; Leavenworth, —12 inches; Dodge City, —2 inches; Fort Sill, —12 inches; Fort Davis, —6 inches; Galveston, —9 inches. It will be understood that the deficiency of 2 inches at Dodge City means more than the same would at Leavenworth, as the total precipitation is only about half at the former, as compared with the latter. Instances of as small a precipitation at Leavenworth back to 1837, are as follows: 1864, —19 inches; 1860, —15 inches; 1847, —14 inches; 1843, —19 inches. Taking the mean of each five years we find the following values and deficit or excess:

Pentacle.	Mean.	Defect or excess.	Pentacle.	Mean.	Defect or excess.
	Inches.	Inches.		Inches.	Inches.
1837-'41	31.42	—3.10	1867-'71	38.83	+4.31
1842-'46	29.32	—5.20	1872-'76	38.66	+4.14
1847-'51	33.35	—1.17	1877-'81	41.11	+6.59
1852-'56	31.28	—3.24	1882-'86	35.58	+1.06
1857-'61	35.37	+0.85			
1862-'66	30.34	—4.18	Mean	34.52	

It should be noted that the period of observation is not sufficient to enable a perfectly satisfactory deduction, but it is plain that there has been a marked increase in precipitation during the last twenty years. The apparent falling off in the last five years is not unexpected, and does not indicate a permanent diminution, as it is mostly due to the small amount in 1886, and there have been four annual records previously, with a greater falling off than in 1886. We may conclude that the scarcity of rainfall in 1886 is not unprecedented, and that from past observations there is no proof of a permanent diminution in precipitation. Many more years' observations will be needed to establish a marked secular variation.

We may consider that opening up the land to tillage, planting trees, and general covering of many square miles with vegetation that were formerly barren wastes, has a tendency to retain the moisture from the clouds and this in turn renders the air slightly more humid, so that there has been an actual increase in the rainfall, and so long as these favoring influences continue there is no danger of a relapse to former conditions. A diminution for one or two

years will be followed by an increase, and the average precipitation will continue or increase.

A proof of the general increase of moisture in the soil is given in the biennial report quoted above, in fact that, notwithstanding the increase of springs emptying into the water courses, there seems to be a tendency to a less flow of water in the streams. This seems to show a retention of moisture in the soil and a consequent increase of springs.

While this investigation applies more particularly to the eastern part of Kansas, because we have no long series of records either in western Kansas or Texas, yet from a comparison of rainfall records during the past fifteen years, we find that the fluctuations in these regions do not materially differ from those in the region here considered. The same principles here enunciated apply to Texas, except as modified by a less cultivation of the soil and a less covering of the surface by vegetation. Farmers in these regions need fear no permanent change in the climate for the present at least.

It is to be hoped that increased accuracy in observation and a larger number of observers reporting rainfall, clouds, and humidity will be had, so that in the near future we may have a still better basis for deductions regarding these very important elements. There should be intelligent voluntary observers in every county reporting to each state weather service.

COMPARISONS OF SIGNAL SERVICE BAROMETERS WITH STANDARD BAROMETERS IN EUROPE AND THE UNITED STATES.

[Abstract from report by Junior Prof. F. WALDO, Signal Service.]

Comparisons of various standard barometers in Europe and the United States were made by Junior Prof. F. Waldo, of the Signal Service, and others, in the years 1882-1883, by means of portable barometers. The results of these and some subsequent barometer comparisons are given here.

The portable barometers used were syphon-barometers, of the form known as the Wild control-barometer, made by Fuess, of Berlin. The inside diameter of tube is 11 mm. The scales are graduated to millimeters on continuous brass, and are silvered. The mercury in open end of syphon is adjustable, by means of a screw at the bottom of the instrument, to the lower edge of an index which is movable. The lower edge of the index is made to coincide nearly with the zero of the scale graduation.

The lower indices of F. 141 and 152 were by accident slightly changed just before the comparisons at Kew. After the change the difference between Cent. Obs. Nor. and F. 141 is taken as —0.25 mm. instead of —0.30, which it was before, and the difference between Cent. Obs. Nor. and F. 152 as 0.00, instead of —0.11 mm.

Fuess Nos. 141, 150, and 152 were compared, at the Central Physical Observatory, Saint Petersburg, Russia, with Browning No. 44, a barometer reading on the Fortin principle. The observations were made in August, September, and December, 1882, by H. Wild, A. Bellikow, M. Rykatschew, Ed. Stelling, and B. Stresnewsky. Fuess No. 132 was compared with Browning No. 44 June, 12, 13, 14, and 15, 1883, by Ed. Stelling and F. Waldo. The correction of Browning No. 44 to reduce to Wild's normal barometer at the Central Observatory was known. The term normal applied to a barometer indicates its sources of errors have been investigated and allowed for in its readings. This normal barometer was very carefully and thoroughly investigated by Wild. It is a syphon tube of over one inch internal diameter. The graduation corrections and coefficient of expansion of its scale were determined. Correction was made for the pressure of any slight amount of air the vacuum chamber contained, and for any slight deviation in density of the mercury with which it was filled from the density of pure mercury. It is observed by a cathetometer with two telescopes. The pointings with micrometer wires are made directly to the tops of the mercurial columns.

The following are the differences between this normal and the Fuess barometers:

Cent. Obs. Nor.	— F. 141 = —0.30
"	— F. 150 = —0.20
"	— F. 152 = —0.11
"	— F. 132 = —0.09

After the changes in the lower indices of F. 141 and F. 152 at Kew the standing of these barometers was as follows:

Cent. Obs. Nor.	— F. 141 = —0.25
"	— F. 152 = —0.00

In March, 1883, F. 150 was compared at Berlin with F. 76, the working standard of the Prussian Meteorological Service, by G. Hellman, with the following result:

F. 76 — F. 150	= —0.14
∴ Cent. Obs. Nor. — F. 76	= —0.06

In March, 1883, F. 141, 150, and 152, were compared at Berlin with Fuess 38, belonging to the Normal Aichungs Kommission, by M. Thiesen and H. F. Wiebe. These, with the equation between Fuess 38 and the Fuess Normal, also belonging to the Normal Aichungs Kommission, give the following for the differences between those barometers and the Central Observatory Normal:

Fuess 38 — F. 141	= —0.28,
∴ Cent. Obs. Nor. — Fuess 38	= —0.02;
Fuess 38 — F. 150	= —0.14,
∴ Cent. Obs. Nor. — Fuess 38	= —0.06;

Fuess 38 — F. 152 = -0.08,
 ∴ Cent. Obs. Nor. — Fuess 38 = -0.03;
 Fuess Nor. — Fuess 38 = +0.20,
 ∴ Cent. Obs. Nor. — Fuess Nor. = -0.22;
 ∴ Cent. Obs. Nor. — Fuess Nor. = -0.26;
 ∴ Cent. Obs. Nor. — Fuess Nor. = -0.23;

April 27, 28, 30, and May 2, 3, 4, 5, 6, 1883, F. 141, 150, 152 were compared at Vienna with the standard barometer Pistor 279 of the Central Anstalt für Meteorologie und Erdmagnetismus, by St. Kostlivy, J. M. Pernter, and F. Waldo, with the following results:

mm.
 Pistor 279 — F. 141 = -0.24,
 ∴ Cent. Obs. Nor. — Pistor 279 = -0.06;
 Pistor 279 — F. 150 = -0.15,
 ∴ Cent. Obs. Nor. — Pistor 279 = -0.05;
 Pistor 279 — F. 152 = -0.01,
 ∴ Cent. Obs. Nor. — Pistor 279 = -0.10.

June 30, July 2, 3, 1883, at Hamburg, F. 141, 150, 152, 182, were compared with Fuess 9 of the Deutsche Seewarte, by A. Sprung and F. Waldo. The same barometers were compared at the same place August 9th to 23d, 1883, after F. 141 and F. 152 had been taken to Kew and brought back. Another series of comparisons of the same barometers was made September 7th, 10th, 11th, 1883, after the journey to Paris. In the last two series the lower indices of F. 141 and F. 152 were in slightly different positions from what they were in the first series, due to change at Kew. The following are the results:

June-July, 1883.
 mm.
 Fuess 9 — F. 141 = +0.19,
 ∴ Cent. Obs. Nor. — Fuess 9 = -0.49;
 Fuess 9 — F. 150 = +0.29,
 ∴ Cent. Obs. Nor. — Fuess 9 = -0.49;
 Fuess 9 — F. 152 = +0.35,
 ∴ Cent. Obs. Nor. — Fuess 9 = -0.46;
 Fuess 9 — F. 182 = +0.45,
 ∴ Cent. Obs. Nor. — Fuess 9 = -0.54.
 August, 1883.
 Fuess 9 — F. 141 = +0.24,
 ∴ Cent. Obs. Nor. — Fuess 9 = -0.49;
 Fuess 9 — F. 150 = +0.34,
 ∴ Cent. Obs. Nor. — Fuess 9 = -0.54;
 Fuess 9 — F. 152 = +0.47,
 ∴ Cent. Obs. Nor. — Fuess 9 = -0.47;
 Fuess 9 — F. 182 = +0.43,
 ∴ Cent. Obs. Nor. — Fuess 9 = -0.52.
 September, 1883.
 Fuess 9 — F. 141 = +0.22,
 ∴ Cent. Obs. Nor. — Fuess 9 = -0.47;
 Fuess 9 — F. 150 = +0.32,
 ∴ Cent. Obs. Nor. — Fuess 9 = -0.52;
 Fuess 9 — F. 152 = +0.43,
 ∴ Cent. Obs. Nor. — Fuess 9 = -0.43,
 Fuess 9 — F. 182 = +0.44,
 ∴ Cent. Obs. Nor. — Fuess 9 = -0.53.

The mean of these values gives:

Cent. Obs. Nor. — Fuess 9 = -0.496.

In March, 1886, Prof. Neumayer found for the difference between Fuess 9 and the new normal barometer of the Seewarte by Fuess,

mm.
 Seewarte Nor. Fuess — Fuess 9 = -0.454
 ∴ Cent. Obs. Nor. — Seewarte Nor. Fuess = -0.04

F. 141 and 152 were compared at Kew Observatory, England, with Newman 34 on July 28, 29, 30, 1883, by Mr. Foster and F. Waldo, with the following result:

mm.
 Newman 34 — F. 141 = -0.08
 Kew Normal — Newman 34 = -0.08
 ∴ Cent. Obs. Nor. — Kew Normal = -0.09
 Newman 34 — F. 152 = +0.13
 ∴ Cent. Obs. Nor. — Kew Normal = -0.05

F. 141 and 152 were compared on August 30, 31, and September 1, 1883, at Sèvres, France, with barometers Fuess 137 and W. II (Turrettini) at the International Bureau of Weights and Measures. The equations between W. II and Normals I and II of the Bureau are known. The equation for F. 137 is not known.

Normal I is of nearly the same construction and is read in the same manner as Wild's normal at St. Petersburg. Normal II is also somewhat like Wild's, but is read differently. A collimating telescope is so arranged that

an image of a set of coarse cross-wires is formed inside the barometer tube and at a distance of about 0.1 mm. above the surface of mercury. The micrometer wire of viewing telescope on cathetometer is read on the direct image of the cross wires and on their reflection from the surface of mercury. The mean of the two readings is taken as the reading of the top of the column of mercury. This method of observing, first used by Marek, is a most satisfactory way of observing accurately the position of a mercurial surface in a wide tube.

mm.
 Fuess 137 — F. 141 = -0.08
 ∴ Cent. Obs. Nor. — Fuess 137 = -0.17
 Fuess 137 — F. 152 = +0.20
 ∴ Cent. Obs. Nor. — Fuess 137 = -0.20
 W II (Turrettini) — F. 141 = -0.19
 Int. Bur. Nor. I — W II = +0.13
 ∴ Cent. Obs. Nor. — Int. Bur. Nor. I = -0.19
 W II (Turrettini) — F. 152 = +0.08
 ∴ Cent. Obs. Nor. — Int. Bur. Nor. I = -0.21
 Int. Bur. Nor. II — W II = +0.10
 ∴ Cent. Obs. Nor. — Int. Bur. Nor. II = -0.16
 ∴ Cent. Obs. Nor. — Int. Bur. Nor. II = -0.18

September 1, 2, 1883, F. 141 and F. 152 were compared with the standard Alvergriat barometer at the Central Meteorological Bureau at Paris, by F. Waldo. The equation between the Alvergriat barometer and Regnault's normal barometer, College de France, was known. The following are the results:

Alvergriat — F. 141 = -0.19
 Regnault's Nor. — Alvergriat = -0.04
 ∴ Cent. Obs. Nor. — Regnault's Nor. = -0.02
 Alvergriat — F. 152 = +0.05
 ∴ Cent. Obs. Nor. — Regnault's Nor. = -0.01

September 3, 1883, F. 141 and F. 152 were compared with the standard Fortin barometer at the Paris Astronomical Observatory, with the following results. The correction of attached thermometer of Fortin was found to be +0° 3:

Fortin — F. 141 = -0.39
 ∴ Cent. Obs. Nor. — Fortin = +0.14
 Fortin — F. 152 = -0.14
 ∴ Cent. Obs. Nor. — Fortin = +0.14

On dates from Oct. 15 to Oct. 25, 1883, F. 152, 141, and 182 were compared by F. Waldo and T. Russell at the Signal Office, Washington City, with barometers Adie Nos. 1526, 1555, and Green Standard. The same barometers and also F. 150 were compared June 7, 9, 10, 11, 1884, by T. Russell and W. H. Hammon. The following are the results, no instrumental corrections being applied to Green Standard, Adie 1526, or the Fuess barometers:

October, 1883.
 F. 152 — Green St'd. = -0.24
 ∴ Cent. Obs. Nor. — Green St'd. = -0.24
 F. 141 — Green St'd. = +0.01
 ∴ Cent. Obs. Nor. — Green St'd. = -0.24
 F. 182 — Green St'd. = -0.30
 ∴ Cent. Obs. Nor. — Green St'd. = -0.39
 June, 1884.
 F. 152 — Green St'd. = -0.38
 ∴ Cent. Obs. Nor. — Green St'd. = -0.38
 F. 141 — Green St'd. = -0.10
 ∴ Cent. Obs. Nor. — Green St'd. = -0.35
 F. 182 — Green St'd. = -0.27
 ∴ Cent. Obs. Nor. — Green St'd. = -0.36
 F. 150 — Green St'd. = -0.19
 ∴ Cent. Obs. Nor. — Green St'd. = -0.39

The means of these give:

mm.
 F. Waldo, October, 1883, Cent. Obs. Nor. — Green St'd. = -0.29
 T. Russell, June, 1884, Cent. Obs. Nor. — Green St'd. = -0.37

Whenever Green Standard is used a correction of -0.004 in., equal to -0.10 mm. is applied to its readings. This is the amount by which the 30-inch mark of scale is less in distance than thirty inches above the ivory point in cistern. The difference then between pressures assigned by Cent. Obs. Nor. and Green Standard is -0.19 mm. according to F. Waldo, and -0.27 according to T. Russell, the Cent. Obs. Nor. being lower.

October, 1883.
 mm.
 F. 152 — Adie 1526 = -0.06
 ∴ Cent. Obs. Nor. — Adie 1526 = -0.06
 F. 141 — Adie 1526 = +0.18
 ∴ Cent. Obs. Nor. — Adie 1526 = -0.07
 June, 1884.
 F. 152 — Adie 1526 = -0.25
 ∴ Cent. Obs. Nor. — Adie 1526 = -0.25

F. 141 — Adie 1526	= +0.03
∴ Cent. Obs. Nor. — Adie 1526	= -0.22
F. 132 — Adie 1526	= -0.16
∴ Cent. Obs. Nor. — Adie 1526	= -0.25
F. 150 — Adie 1526	= -0.03
∴ Cent. Obs. Nor. — Adie 1526	= -0.23

The means of these give:

F. Waldo, October, 1883, Cent. Obs. Nor. — Adie 1526	= -0.06 mm.
T. Russell, June, 1884, Cent. Obs. Nor. — Adie 1526	= -0.24

The barometer Adie 1526, with a correction of +0.002 inch, equal to 0.05 mm., was adopted by General Greeley as the standard of the Signal Service in March, 1887. This barometer has been practically the Signal Service standard since December, 1880. With the correction of +0.002 applied, the difference between pressures as assigned by Cent. Obs. Nor. and Adie 1526 is -0.11 mm. as observed by F. Waldo, and -0.29 as observed by T. Russell, the Cent. Obs. Nor. being lower. These figures do not indicate change in the barometers but personal differences in the way of observing.

October, 1883.

F. 152 — Adie 1555	= -0.27 mm.
∴ Cent. Obs. Nor. — Adie 1555	= -0.27
F. 132 — Adie 1555	= -0.29
∴ Cent. Obs. Nor. — Adie 1555	= -0.38

June, 1884.

F. 152 — Adie 1555	= -0.33
∴ Cent. Obs. Nor. — Adie 1555	= -0.33
F. 132 — Adie 1555	= -0.26
∴ Cent. Obs. Nor. — Adie 1555	= -0.35
F. 141 — Adie 1555	= -0.06
∴ Cent. Obs. Nor. — Adie 1555	= -0.31
F. 150 — Adie 1555	= -0.19
∴ Cent. Obs. Nor. — Adie 1555	= -0.39

The means of these give:

F. Waldo, October, 1883, Cent. Obs. Nor. — Adie 1555	= -0.32 mm.
T. Russell, June, 1884, Cent. Obs. Nor. — Adie 1555	= -0.34

The barometer Adie 1555 was used with a correction of +0.002 inch, equal to +0.05 mm., therefore the difference between Cent. Obs. Nor. and Adie 1555, as found by Waldo, was -0.37 mm., and as found by Russell, -0.39 mm.

This barometer was fitted with a new tube and otherwise altered October, 1885, so the above correction no longer applies.

F. 152 was compared at Yale College Observatory, New Haven, with a Green barometer and with the new standard of the Panama Canal Survey, October 27, 1883, by F. Waldo. At Harvard College Observatory, Cambridge, F. 152 was compared with Newman 68, October 31 and November 1, 1883, by A. Searle and F. Waldo.

F. 152 was compared with the barometers 465 and 1707 at the Signal Service station, Boston, November 2 and 3, 1883, by O. B. Cole and F. Waldo, and with Newman No. 33 at the Canadian Meteorological Observatory, Toronto, by C. Carpmal and F. Waldo.

The same barometer, F. 152, was compared on November 13 and 14, with the Signal Service barometer Adie 1600 at the Maritime Exchange, New York, by F. Waldo, and with Adie 1712 at the Maritime Exchange, Philadelphia, by Mr. Townsend and F. Waldo.

F. 141, 152, 150, and 132 were compared with F. 177 and 178 at the Signal Office, Washington City, in June, 1884, by T. Russell and W. H. Hammon.

The adopted results of all the comparisons are summarized in the following table:

Table of final adopted results.

St. Petersburg Cent. Obs. Nor. — Berlin, Preuss. Stat. Bur. F. 76	= -0.04 mm.
" — Berlin, Nor. Aich. Kom. F. 38	= -0.05
" — Berlin, Nor. Aich. Kom. F. Nor.	= -0.25
" — Vienna, Cent. Anst. Pistor 279	= -0.08
" — Hamburg, Seewarte, F. 9	= -0.50
" — Hamburg, Seewarte, Fuess Nor.	= -0.04
" — Kew, Normal	= -0.10
" — Paris, Int. Bur. F. 137	= -0.18
" — Paris, Int. Bur. Nor. I	= -0.24
" — Paris, Int. Bur. Nor. II	= -0.20
" — Paris, Regnault's Nor. College de France	= -0.05
" — Washington, Sig. Ser. Green St'd, with correction of -0.10 mm. applied; Waldo	= -0.19
" — Washington, Sig. Ser. Green St'd, with correction of -0.10 mm. applied; Russell	= -0.27
" — Washington, Sig. Ser. St'd Adie 1526, with correction of +0.05 mm. applied; Waldo	= -0.11

St. Petersburg Cent. Obs. Nor. — Washington, Sig. Ser. St'd Adie 1526, with correction of +0.05 mm. applied; Russell	= -0.29
" — Washington, Sig. Ser. Adie 1555, with correction of +0.05 mm. applied; Waldo	= -0.37
" — Washington, Sig. Ser. Adie 1555, with correction of +0.05 mm. applied; Russell	= -0.39
" — New Haven, Yale Obs., Green	= -0.02
" — New Haven, Green 2725, Panama Canal St'd	= -0.16
" — Cambridge, Har. Col. Obs., Newman 68	= +0.19
" — Boston, Sig. Ser. No. 465	= +0.35
" — Boston, Sig. Ser. No. 1707	= -0.05
" — Toronto, Met. Obs., Newman 33, with correction of +0.18 mm. applied	= -0.14
" — New York, Maritime Exchange, Adie 1600	= -0.29
" — Philadelphia, Maritime Exchange, Adie 1712	= -0.05

In these comparisons of barometers no account was taken of any slight variations there might be in the height of meniscus in open end of the Fuess syphon barometers. The capillary action of the glass on the surface of the mercury will vary a little from time to time with the height of meniscus, depending on the cleanness of the glass. During the time of the comparisons this action was assumed to be constant.

The corrections of the Fuess barometers used in the Table of Final Results to reduce to the Central Obs. Nor. at St. Petersburg are given below, and also the positions of their lower indices as determined in June, 1884, and July, 1886. The corrections of F. 177 and F. 178 are the corrections determined from comparisons with F. 141, 150, 152, and 132 after they had reached Washington City:

F. 141 — 0.25, lower index exactly at zero of graduation.
F. 150 — 0.20, lower index 0.14 mm. above zero of graduation.
F. 152 — 0.00, lower index 0.01 mm. below zero of graduation.
F. 132 — 0.09, lower index exactly at zero of graduation.
F. 177 — 0.11, lower index exactly at zero of graduation.
F. 178 — 0.11, lower index 0.08 mm. below zero of graduation.

ATMOSPHERIC ELECTRICITY.

[Translated by Sergeant ALEX. MCADIE, Signal Corps.]

The following is from a long and important article by Prof. F. Exner, "Ueber die Ursache und die Gesetze der atmosphärischen Electricität." "Repertorium der Physik, xxii Band. Heft 7-8, 1886." Only that portion bearing on the relation of atmospheric electricity to meteorology is here given, and in an abridged form:

Peltier's theory, in which the earth is considered simply as an electrified ball, isolated in space, and causing by induction a charged atmosphere, is considered by the author as the theory best in accord with all the experimental determinations thus far made.

Of the three different agencies for getting the electrification of the air, viz., by flame, water dropping, and the burning match, the first named, according to Pellat, is the most, and the match the least, efficient of collectors.

All the different observations seem to agree in this, that in ordinary fine weather the potential of the air is positive compared with that of the earth. The condition of cloudiness has a marked effect upon the values of the potential, and especially when thick cumuli clouds are in proximity of the place of observation, variations and occasional negative values are likely to occur. Franklin, Beccaria, Le Monnier, Cavallo, Saussure, and their contemporaries, agree in this. Negative values, as a rule, occur during stormy weather. Quetelet, observing for four years, found only twenty-three instances of negative electricity, and these always during stormy or rainy weather. Birt, in five years, had 14,515 cases of positive and only 665 cases of negative electricity, and these last, as a rule, at times of rapid cloud-formation. Results of a like nature were obtained by Lamont at Munich, by Dellmann at Kreuznach, and Palmieri at Naples. F. Duprez found, on an average, twenty-three cases of positive to one negative indication, and the latter generally during thunder-storms. Everett, from observations in Nova Scotia, obtained similar results. Exner's own experience has been, that in normal weather, omitting local influence, negative electricity is very rare. Dellmann gives as a law, based upon twenty years' experience, that "the atmospheric electricity at a place is, as a rule, of one sign." This important fact has also been commented upon by Wislizenus, at Saint Louis, Mo., and elsewhere. Not only above the earth surface, but also above the sea surface, is the air in its normal condition positively electrified.

In general, the observations referred to above have shown that the difference between the potentials of the air and the ground increases with height. Beccaria noticed that the higher his collecting apparatus the greater the indications. Lamanon and Mongez found always a strong positive indication on the Peak

Districts and stations.	Stations established.	Winter of—												
		1873-'74.	1874-'75.	1875-'76.	1876-'77.	1877-'78.	1878-'79.	1879-'80.	1880-'81.	1881-'82.	1882-'83.	1883-'84.	1884-'85.	1885-'86.
<i>New England.</i>														
Eastport, Me.....	Apr. 1, 1873	Apr. 30	Apr. 31	May 12	Apr. 13	Apr. 7	Apr. 19	Apr. 17	Apr. 16	May 15	May 15	May 12	May 2	Mar. 23
Portland, Me.....	Jan. 15, 1871	Apr. 30	Apr. 14	Apr. 19	Apr. 12	Apr. 1	Apr. 19	Apr. 17	Apr. 16	May 15	Apr. 8	May 10	May 2	Apr. 8
Mount Washington, N. H.....	Dec. 1, 1870	a	a	a	a	a	a	a	a	a	a	May 30	a	a
Boston, Mass.....	Nov. 1, 1870	Apr. 28	Apr. 19	May 5	Apr. 12	Mar. 23	Apr. 19	Apr. 24	Apr. 14	Apr. 10	Apr. 24	Apr. 3	Apr. 2	Apr. 8
Block Island, R. I.....	Sept. 1, 1880								Mar. 19	Apr. 11	Mar. 30	Apr. 3	Mar. 29	Apr. 5
New Haven, Conn.....	Dec. 10, 1872	Apr. 28	Apr. 19	May 1	Mar. 25	Mar. 17	Apr. 19	May 1	Apr. 12	May 9	Apr. 29	Apr. 18	Apr. 11	Apr. 5
New London, Conn.....	Jan. 10, 1871	Apr. 28	Apr. 19	May 11	Apr. 21	May 15	Apr. 19	May 1	Apr. 15	Apr. 10	Apr. 29	Apr. 3	Mar. 29	Apr. 5
<i>Middle Atlantic states.</i>														
Albany, N. Y.....	Dec. 22, 1873	Apr. 29	Apr. 18	Apr. 30	Mar. 28	Apr. 5	Apr. 19	May 1	Apr. 13	May 1	Apr. 23	Apr. 5	May 1	Apr. 8
New York City.....	Nov. 1, 1870	Apr. 29	Apr. 24	Mar. 25	Mar. 28	Apr. 23	Mar. 17	Apr. 7	Mar. 31	Apr. 11	Apr. 29	Apr. 5	Apr. 29	Apr. 5
Philadelphia, Pa.....	Jan. 1, 1871	Apr. 29	Apr. 19	Mar. 24	Mar. 28	Apr. 24	Apr. 12	Apr. 12	Apr. 6	Apr. 10	Mar. 30	Apr. 9	Apr. 15	Apr. 5
Atlantic City, N. J.....	Dec. 10, 1873	Apr. 29	Apr. 18	Mar. 20	Mar. 28	Feb. 26	Mar. 19	Mar. 19	Apr. 6	Mar. 22	Apr. 1	Apr. 7	Apr. 11	Feb. 4
Barnegat City, N. J.....	Dec. 10, 1873	Apr. 29	Apr. 13	Mar. 20	Mar. 28	Feb. 2	Apr. 4	Mar. 29	Mar. 31	Apr. 10	Apr. 1	Apr. 9	Apr. 29	
Cape May, N. J.....	May 24, 1871	d	Apr. 19	Mar. 20	Mar. 28	Feb. 26	Mar. 29	Mar. 28	Mar. 31	Mar. 16	Mar. 31	Mar. 5	Mar. 22	
Sandy Hook, N. J.....	Dec. 10, 1873	d	Apr. 4	Apr. 18	Mar. 30	Mar. 25	Mar. 17	Mar. 14	Apr. 6	Mar. 16	Apr. 29	Mar. 6	Apr. 11	Apr. 4
Baltimore, Md.....	Jan. 1, 1871	Apr. 29	Apr. 18	Mar. 30	Mar. 28	Feb. 15	Apr. 15	Mar. 29	Apr. 4	Apr. 11	Apr. 31	Apr. 9	Apr. 11	Mar. 8
Washington City.....	Nov. 1, 1870	Apr. 29	Apr. 18	Mar. 30	Mar. 28	Feb. 13	Feb. 19	Mar. 12	Apr. 4	Apr. 23	Apr. 1	Apr. 9	Apr. 11	Mar. 12
Cape Henry, Va.....	Dec. 15, 1873		Feb. 7	Feb. 4	Mar. 16	Jan. 18	Feb. 20	Feb. 10	Apr. 4	Jan. 4	Jan. 16	Feb. 23	Apr. 10	Mar. 8
Chincoteague, Va.....	Mar. 16, 1880								Apr. 4	Mar. 18	Apr. 2	Apr. 9	Mar. 22	Mar. 17
Lynchburg, Va.....	May 24, 1871	Apr. 29	Apr. 17	Mar. 20	Apr. 13	Jan. 31	Feb. 17	Mar. 12	Mar. 30	Mar. 15	Apr. 2	Apr. 9	Apr. 13	Apr. 7
Norfolk, Va.....	Jan. 1, 1871	d	Apr. 18	Mar. 20	Mar. 18	Jan. 8	Feb. 16	Jan. 13	Mar. 31	Mar. 12	Mar. 23	Mar. 5	Apr. 13	Mar. 8
<i>South Atlantic states.</i>														
Charlotte, N. C.....	Oct. 6, 1878					Feb. 14	Feb. 2	Apr. 1	Jan. 31	Jan. 26	Mar. 26	Mar. 1	Mar. 23	Mar. 10
Cape Hatteras and Hatteras, N. C.....	Sept. 1, 1874			Mar. 22	Dec. 1	Dec. 27	Feb. 1	Jan. 19	Jan. 24	e	Mar. 22	Jan. 17	Mar. 23	Feb. 4
Kitty Hawk, N. C.....	Jan. 15, 1875		Apr. 18	Feb. 2	Mar. 18	Dec. 2	Feb. 20	Mar. 30	Feb. 23	Jan. 4	Mar. 22	Jan. 17	Mar. 23	Feb. 4
Macon, Fort, N. C.....	May 23, 1878							e	Jan. 25	Jan. 1	Mar. 22	Jan. 17	Mar. 23	Feb. 4
Smithville, N. C.....	Oct. 15, 1875			e	e	e	e	e	Jan. 24	e	e	Jan. 5	e	e
Wilmington, N. C.....	Jan. 1, 1871	e	e	e	e	Feb. 3	Jan. 19	Nov. 30	Jan. 24	Jan. 30	Mar. 22	Jan. 17	Mar. 23	Feb. 28
Charleston, S. C.....	Jan. 3, 1871							e	e	Jan. 30	e	e	e	Feb. 4
Augusta, Ga.....	Nov. 9, 1870	Feb. 8		Mar. 19	Jan. 1	Jan. 8	Feb. 17	Mar. 12	Jan. 14	Jan. 30	Jan. 9	Jan. 7	Mar. 23	Feb. 37
Savannah, Ga.....	Jan. 1, 1871			e	e	e	e	e	e	e	e	e	e	Jan. 9
Jacksonville, Fla.....	Sept. 11, 1871	e	e	e	e	e	e	e	e	e	e	e	e	e

Table showing the dates of the last snowfall at stations of the Signal Service, &c.—Continued.

Districts and stations.	Stations established.	Winter of—												
		1873-'74.	1874-'75.	1875-'76.	1876-'77.	1877-'78.	1878-'79.	1879-'80.	1880-'81.	1881-'82.	1882-'83.	1883-'84.	1884-'85.	1885-'86.
Florida Peninsula.														
Cedar Keys, Fla.	Nov. 7, 1879													
Key West, Fla.	Nov. 1, 1870													
Sanford, Fla.	Sept. 1, 1882													Jan. 12
Eastern Gulf states.														
Atlanta, Ga.	Sept. 25, 1878						Dec. 27	Feb. 2	Mar. 29	Jan. 30	Jan. 9	Mar. 2	Mar. 18	Feb. 27
Pensacola, Fla.	Oct. 27, 1879													
Mobile, Ala.	Nov. 7, 1870						Jan. 4		Jan. 24		Jan. 9			
Montgomery, Ala.	Nov. 9, 1870						Jan. 5		Jan. 24		Jan. 9	Jan. 24	Feb. 12	Jan. 9
Vicksburg, Miss.	Sept. 10, 1871						Jan. 9	Feb. 2	Jan. 10		Jan. 9	Jan. 8	Feb. 12	
New Orleans, La.	Nov. 1, 1870	Mar. 23	Mar. 7	Mar. 20	Jan. 1	Jan. 1	Dec. 26	Jan. 5	Jan. 24	Dec. 23				
Western Gulf states.														
Shreveport, La.	Sept. 3, 1871	Jan. 16	Mar. 16		Dec. 31	Jan. 3	Jan. 8	Dec. 25	Jan. 20	Jan. 29	Jan. 20	Jan. 7	Feb. 21	Jan. 3
Fort Smith, Ark.	June 1, 1882										Jan. 27	Mar. 8	Feb. 16	Apr. 5
Little Rock, Ark.	July 1, 1879										Feb. 17	Feb. 27	Feb. 16	Apr. 5
Galveston, Tex.	Apr. 19, 1871	Jan. 5												Jan. 12
Indianola, Tex.	May 1, 1872	Jan. 5												Jan. 12
Palestine, Tex.	Dec. 3, 1881		Mar. 6	Mar. 20	Dec. 28	Jan. 3	Jan. 3	Feb. 3	Jan. 29		Feb. 18	Feb. 17	Feb. 13	Jan. 23
San Antonio, Tex.	Sept. 22, 1875						Feb. 6	Mar. 14	Jan. 9					Jan. 13
Rio Grande Valley.														
Brownsville, Tex.	Aug. 25, 1875							Dec. 25	Dec. 31					
Rio Grande City, Tex.	May 28, 1875													Jan. 12
Ohio Valley and Tennessee.														
Chattanooga, Tenn.	Jan. 8, 1879						Feb. 16	Apr. 8	Apr. 4	Jan. 31	Mar. 21	Mar. 4	Mar. 18	Apr. 5
Knoxville, Tenn.	Jan. 1, 1871	Apr. 29	Mar. 7	Mar. 28	Mar. 9	Feb. 11	Feb. 18	Feb. 3	Apr. 5	Feb. 4	Mar. 21	Apr. 9	Apr. 13	Apr. 5
Memphis, Tenn.	Feb. 28, 1871	Apr. 9	Mar. 7	Mar. 19	Mar. 25	Feb. 3	Feb. 5	Feb. 2	Mar. 19	Jan. 31	Mar. 21	Mar. 4	Mar. 8	Mar. 31
Nashville, Tenn.	Nov. 1, 1870	Feb. 25	Mar. 22	Mar. 28	Mar. 9	Feb. 10	Mar. 15	Feb. 3	Apr. 4	Feb. 21	Mar. 21	Mar. 3	Mar. 28	Apr. 7
Louisville, Ky.	Sept. 11, 1871	Jan. 7	Feb. 25	Feb. 15	Feb. 14	Feb. 10	Feb. 17	Feb. 3	Apr. 28	Feb. 21	Apr. 1	Apr. 10	Apr. 14	Apr. 7
Greencastle, Ind.	July 23, 1884													Apr. 6
Indianapolis, Ind.	Feb. 10, 1871	Feb. 13	Apr. 17	Mar. 28	Apr. 30	Feb. 25	Mar. 20	Mar. 25	Apr. 4	Apr. 11	Apr. 22	Apr. 9	Apr. 14	Apr. 6
Cincinnati, Ohio	Nov. 1, 1870	Apr. 9	Apr. 24	Mar. 28	May 1	Mar. 24	Mar. 19	Mar. 25	Apr. 15	Apr. 10	May 22	Apr. 8	Mar. 28	Apr. 7
Columbus, Ohio	July 1, 1878						Apr. 3	Mar. 15	Apr. 5	Apr. 10	May 21	Apr. 9	Apr. 15	Apr. 7
Pittsburg, Pa.	Nov. 1, 1870	Apr. 28	May 2	Apr. 30	May 1	Mar. 25	Apr. 5	Apr. 11	Apr. 6	Apr. 15	Apr. 24	Apr. 9	May 10	Apr. 7
Lower lakes.														
Buffalo, N. Y.	Nov. 1, 1870	Apr. 26	Apr. 17	Apr. 30	Apr. 5	Mar. 25	May 1	May 1	Apr. 13	May 2	Apr. 28	Apr. 17	May 9	Apr. 8
Oswego, N. Y.	Nov. 1, 1870	May 2	May 2	Apr. 30	Apr. 21	Mar. 26	Apr. 11	Apr. 30	Apr. 13	Apr. 11	Apr. 28	May 16	May 10	Apr. 8
Rochester, N. Y.	Nov. 1, 1870	May 2	May 2	Apr. 30	Apr. 5	May 12	May 3	Apr. 12	Apr. 13	Apr. 12	Apr. 28	May 16	May 10	Apr. 8
Erie, Pa.	May 25, 1873	Apr. 11	May 2	Apr. 30	Apr. 5	Mar. 24	Apr. 5	Apr. 10	Apr. 13	Apr. 12	Apr. 24	Apr. 17	May 9	Apr. 7
Cleveland, Ohio	Nov. 1, 1870	Apr. 30	May 2	Mar. 30	May 1	Mar. 24	Apr. 5	Apr. 30	Apr. 13	Apr. 15	Mar. 27	Apr. 8	May 9	Apr. 7
Sandusky, Ohio	Aug. 2, 1877					Mar. 24	Apr. 20	Apr. 10	Apr. 15	Apr. 10	d	Apr. 9	May 9	Apr. 6
Toledo, Ohio	Nov. 1, 1870	Apr. 30	May 2	Mar. 30	May 1	Mar. 24	Apr. 15	Apr. 10	Apr. 13	Apr. 11	May 21	Apr. 9	May 9	Apr. 7
Detroit, Mich.	Nov. 1, 1870	Apr. 30	May 1	Mar. 30	May 1	Mar. 30	Apr. 4	Apr. 11	Apr. 12	Apr. 10	May 21	Apr. 16	Apr. 14	Apr. 7
Upper lakes.														
Alpena, Mich.	Sept. 10, 1872	d	Apr. 21	Apr. 18	Apr. 27	June 8	June 7	June 3	June 11	May 23	May 21	May 15	May 10	Apr. 4
Escanaba, Mich.	May 24, 1871	Apr. 29	May 5	May 3	May 3	May 13	Apr. 3	Apr. 10	Apr. 5	May 16	Apr. 27	May 2	May 10	Apr. 24
Grand Haven, Mich.	May 24, 1871	Apr. 11	May 1	May 30	May 1	Mar. 30	Apr. 3	Apr. 10	Apr. 13	Apr. 20	Apr. 22	Apr. 16	May 8	Apr. 3
Mackinaw City, Mich.	Aug. 20, 1882													May 16
Marquette, Mich.	May 1, 1871	Apr. 22	May 4	May 4	Apr. 30	May 11	May 5	Apr. 30	Apr. 29	May 22	May 20	May 2	May 10	May 6
Port Huron, Mich.	July 25, 1874		Apr. 24	Apr. 30	May 1	Mar. 30	Apr. 5	Apr. 30	Apr. 11	May 2	May 22	Apr. 6	May 9	Apr. 7
Chicago, Ill.	Nov. 1, 1870	May 27	May 1	Apr. 14	Mar. 25	Mar. 30	Apr. 2	Apr. 30	Apr. 13	May 23	Apr. 6	Apr. 20	Apr. 14	Mar. 31
Milwaukee, Wis.	Nov. 1, 1870	Apr. 11	May 2	Apr. 30	Apr. 29	Mar. 31	Apr. 2	Apr. 16	Apr. 12	Mar. 22	Apr. 7	Apr. 20	Apr. 14	Apr. 1
Duluth, Minn.	Nov. 1, 1870	Apr. 21	May 1	May 3	Apr. 5	Mar. 26	Apr. 2	Apr. 19	Apr. 14	May 22	May 6	Apr. 27	May 7	Apr. 1
Upper Mississippi valley.														
Saint Paul, Minn.	Nov. 1, 1870	Apr. 14	Apr. 29	May 3	Apr. 9	Mar. 31	Apr. 2	Apr. 20	Apr. 11	Mar. 21	Apr. 22	Apr. 9	May 8	Apr. 1
La Crosse, Wis.	Oct. 15, 1872	Apr. 20	May 1	Apr. 3	Apr. 29	May 4	Apr. 2	Apr. 16	Apr. 12	Mar. 21	Apr. 21	Apr. 15	May 9	Apr. 1
Davenport, Iowa.	May 24, 1871	Apr. 27	Apr. 16	Mar. 28	Apr. 29	Mar. 30	Apr. 2	Mar. 18	Apr. 12	Mar. 23	Apr. 6	Apr. 8	Apr. 12	Apr. 1
Des Moines, Iowa	Aug. 1, 1878													Mar. 31
Dubuque, Iowa	July 10, 1873	Apr. 6	May 1	Apr. 2	Apr. 29	Mar. 30	Apr. 2	Apr. 16	Apr. 12	Mar. 21	Apr. 6	Apr. 8	May 7	Apr. 1
Keokuk, Iowa	July 16, 1871	Apr. 16	Apr. 10	Mar. 28	Apr. 29	May 11	Mar. 21	Mar. 16	Apr. 12	Mar. 9	Apr. 23	Apr. 8	Apr. 9	Apr. 3
Cairo, Ill.	June 1, 1871	Apr. 9	Mar. 7	Mar. 28	Mar. 8	Feb. 10	Mar. 16	Mar. 13	Apr. 3	Jan. 31	Mar. 23	Mar. 9	Mar. 28	Mar. 31
Springfield, Ill.	July 1, 1879							Apr. 19	Apr. 12	Apr. 10	Apr. 23	Apr. 22	Apr. 9	Apr. 3
Saint Louis, Mo.	Nov. 1, 1870	Mar. 31	Apr. 12	Mar. 28	Apr. 29	Feb. 24	Mar. 16	Mar. 16	Apr. 4	Mar. 13	Apr. 1	Apr. 22	Apr. 9	Apr. 4
Missouri Valley.														
Lamar, Mo.	Oct. 17, 1884													May 7
Leavenworth, Kans.	May 21, 1871	Apr. 7	Apr. 11	Apr. 13	Apr. 28	Mar. 29	Feb. 25	Mar. 15	Apr. 12	Apr. 11	Mar. 21	Apr. 21	Mar. 28	Apr. 3
Omaha, Neb.	Nov. 1, 1870	Apr. 20	May 2	Apr. 13	Apr. 29	Mar. 30	Mar. 21	Apr. 19	Apr. 4	Apr. 13	Apr. 6	Apr. 21	Apr. 9	Apr. 28
Valentine, Neb.	Jan. 27, 1885													Apr. 28
Bennett, Fort, Dak.	Dec. 22, 1879													
Huron, Dak.	July 1, 1881													
Yankton, Dak.	Apr. 1, 1873	Apr. 4	Apr. 11	Apr. 4	Apr. 28	May 11	Mar. 20	Apr. 18	Apr. 10	Apr. 13	Apr. 23	Apr. 9	May 7	Apr. 28
Extreme northwest.														
Moorhead, Minn.	Jan. 1, 1881	Apr. 6	Apr. 29	June 3	Apr. 4	May 10	Apr. 2	Apr. 25	Apr. 14	May 21	Apr. 15	May 1	May 8	Apr. 27
Saint Vincent, Minn.	Sept. 5, 1880	Apr. 27	May 4	Apr. 30	June 8	May 10	May 5	Apr. 25	Apr. 2	May 21	Apr. 30	Apr. 9	May 8	May 14
Bismarck, Dak.	Sept. 15, 1874		Apr. 29	Apr. 9	Apr. 23	May 11	Apr. 2	Apr. 25	Apr. 11	May 20	Apr. 22	Apr. 28	May 7	Mar. 28
Buford, Fort, Dak.	Oct. 23, 1876							Mar. 21	Apr. 14	May 22	Apr. 4	Apr. 30	May 6	May 1
Totten, Fort, Dak.	Oct. 8, 1883													Apr. 27
Northern slope.														
Assinaboine, Fort, Mont.	Oct. 6, 1879							Apr. 16	Apr. 11	May 19	Apr. 4	Apr. 27	May 7	May 13
Benton, Fort, Mont.	Nov. 25, 1871	d	d	d	d	d	d	Apr. 23	Apr. 22	Apr. 25	May 5	Apr. 27	Apr. 20	Apr. 3
Custer, Fort, Mont.	Dec. 5, 1878								Apr. 11	May 20	d	Apr. 30	Apr. 21	Apr. 28
Helena, Mont.	Oct. 15, 1879								May 28	Apr. 27	May 19	May 2	June 7	May 13
Maginnis, Fort, Mont.	July 14, 1882											d	May 6	May 13
Poplar River, Mont.	May 1, 1882													May 1
Shaw, Fort, Mont.	Apr. 1, 1880													Apr. 28
Deadwood, Dak.	Dec. 18, 1877							May 3	May 23	May 17	May 22	May 29	May 12	May 10
Cheyenne, Wyo.	Nov. 1, 1870	May 13	Apr. 24	May 31	Apr. 28	May 17	Apr. 23	May 30	May 17	May 22	May 28	May 13	May 7	Apr. 28
North Platte, Neb.	Sept. 18, 1874		Apr. 25	May 6	May 23	May 12	Mar. 20	June 27	Apr. 12	May 22	May 2	Apr. 11	May 27	Apr. 4
Middle slope.														
Denver, Colo.	Nov. 19, 1871	Apr. 21	Apr. 25	May 6	Apr. 28	Apr. 9	Apr. 22	May 31	May 17	May 8	May 29	May 1	May 11	Apr. 19
Pike's Peak, Colo.	Nov. 1, 1873	d	d	d	d	d	d	d	d	d	d	d	d	d
West Las Animas, Colo.	Oct. 1, 1881													Apr. 4
Concordia, Kans.	Jan. 27, 1885													Apr. 3
Dodge City, Kans.	Sept. 15, 1874		Apr. 25	Apr. 13	Mar. 23	Feb. 13	Feb. 17	Apr. 7	Apr. 12	Apr. 14	Feb. 24	May 1	May 7	Apr. 4
Elliott, Fort, Tex.	Nov. 29, 1879								Mar. 15	Feb. 18	Feb. 2	Feb. 27	Mar. 24	Apr. 4
Southern slope.														
Sill, Fort, Ind. T.	June 23, 1875			d	d	Feb. 8	Feb. 14	Mar. 15	Feb. 18	Mar. 9	Feb. 3	Mar. 7	Feb. 12	Apr. 4
Abilene, Tex.	Sept. 15, 1885													Mar. 29
Concho, Fort, Tex. j.	Oct. 10, 1875					Jan. 7	Feb. 6	Mar. 15	Jan. 9	e	Feb. 5	Apr. 20	Feb. 13	
Davis, Fort, Tex.	Dec. 24, 1877							Mar. 15	Mar. 20	Apr. 13	Mar. 7	Apr. 30	Feb. 13	Mar. 29
Stockton, Fort, Tex.	Feb. 26, 1876													d
Stanton, Fort, N. Mex.	Jan. 1, 1885				Feb. 28	Jan. 6	Jan. 8							

Table of miscellaneous meteorological data for April, 1887—Signal Service observations.

Station and district.	Elevation above level, feet.	Atmospheric pressure (in inches and hundredths).				Temperature of the air (in degrees Fahrenheit).										Winds.																	
		Mean actual barometer.	Mean reduced barometer.	Departure from normal.	Extremes.				Monthly mean.	Departure from normal.	Extremes.				Monthly range.	Mean relative humidity, per cent.	Mean temperature of the dew-point (degrees Fahrenheit).	Precipitation (in inches).	Departure from normal precipitation (in inches).	Total movement, miles.	Prevailing direction.	Maximum velocity.		No. of rainy days.	No. of cloudy days.	No. of fair days.	No. of clear days.						
					Highest barometer.	Date.	Lowest barometer.	Date.			Monthly range of barometer.	Max.	Date.	Mean max.								Min.	Date.					Mean min.	Monthly range.	Greatest.	Date.	Least.	Date.
New England.																																	
Eastport	53	29.84	29.90	+.06	30.60	8	29.18	29.14	37.5	2.1	66.2	11	44.5	30.5	8	30.3	45.7	28.4	11	5.7	4.72	28.7	3.48	-.06	9,243	n.	50	ne.	3	12	9	9	12
Portland	99	29.83	29.94	+.11	30.64	8	29.11	29.15	40.2	2.8	70.2	10	47.3	31.5	1	32.3	46.7	26.8	22	4.0	16.62	27.1	4.96	+.20	6,311	nw.	36	ne.	29	13	11	9	12
Manchester	71	29.69	29.97	+.08	30.74	8	29.03	30.17	41.6	3.4	70.9	10	51.3	18.4	8	30.5	46.8	40.0	10	5.4	26.65	29.1	2.54	-.07	5,137	nw.	31	w.	6	12	9	9	12
Mount Washington	6,279	23.54	29.97	+.05	30.74	8	29.03	30.17	19.0	3.0	42.1	10	25.7	8.3	16	10.6	50.4	32.5	5	6.2	73.86	16.4	5.17	-.07	118	nw.	46	n.	9	16	6	13	11
Northfield	871	29.61	29.97	+.06	30.68	8	29.13	29.15	35.4	6.6	67.8	10	45.0	1.0	1	34.1	68.8	40.0	9	6.2	16.68	35.4	3.37	-.07	6,253	w.	46	n.	30	13	8	9	12
Boston	134	29.82	29.95	+.03	30.68	8	29.13	29.15	43.9	1.1	79.6	11	52.4	23.0	6	35.1	56.6	29.7	9	7.0	16.62	30.4	2.69	-.12	9,315	w.	40	n.	21	7	10	11	11
Nantucket	14	29.94	29.95	+.01	30.68	8	29.13	29.15	42.0	6.6	68.1	11	48.8	27.0	1	35.1	59.8	25.1	10	4.8	27.5	35.2	6.23	-.07	8,575	w.	53	ne.	21	7	10	11	11
Wood's Holl	14	29.94	29.95	+.01	30.68	8	29.13	29.15	44.7	6.6	68.1	11	48.8	27.0	1	35.1	59.8	25.1	10	4.8	27.5	35.2	6.23	-.07	8,575	w.	53	ne.	21	7	10	11	11
Vineyard Haven	14	29.94	29.95	+.01	30.68	8	29.13	29.15	44.8	6.6	68.1	11	48.8	27.0	1	35.1	59.8	25.1	10	4.8	27.5	35.2	6.23	-.07	8,575	w.	53	ne.	21	7	10	11	11
Block Island	27	29.93	29.95	+.02	30.66	8	29.14	29.15	43.2	+.2	66.8	11	49.7	25.0	6	34.2	54.1	21.9	10	4.3	27.5	36.6	3.49	+.12	12,233	sw.	56	ne.	21	8	11	11	11
Sagadahoc Pier	27	29.93	29.95	+.02	30.66	8	29.14	29.15	42.8	6.6	77.0	10	51.5	23.0	6	38.2	54.0	21.9	10	4.3	27.5	36.6	3.49	+.12	12,233	sw.	56	ne.	21	8	11	11	11
New Haven	107	29.86	29.97	+.01	30.66	8	29.15	29.15	44.4	1.6	80.0	10	53.8	23.0	6	35.5	57.0	38.8	10	7.6	16.65	30.4	2.75	-.12	6,476	nw.	31	ne.	21	13	12	5	9
New London	47	29.91	29.95	-.02	30.66	8	29.14	29.15	45.0	1.6	79.4	15	53.8	23.0	6	35.5	55.8	37.0	10	5.7	26.7	34.7	3.63	-.21	4,302	n.	26	s.	20	12	13	5	9
Mid. Atlantic States.																																	
Albany	85	29.91	30.00	+.02	30.71	8	29.13	29.15	49.5	1.5	82.5	10	52.5	18.0	1	39.2	54.5	31.3	22	5.9	23.71	34.0	2.49	-.03	5,666	nw.	24	s.	23	11	9	12	9
New York City	158	29.82	30.06	+.01	30.66	8	29.18	29.14	47.7	0.3	80.3	10	56.7	25.8	6	39.2	54.5	38.6	10	8.0	15.59	31.3	3.67	+.04	6,067	nw.	29	nw.	30	12	7	17	6
Philadelphia	117	29.90	30.01	+.02	30.67	8	29.25	29.14	49.8	0.2	84.2	11	60.4	27.8	6	41.1	56.4	39.8	10	7.5	15.57	33.8	2.60	-.08	8,446	nw.	37	nw.	30	11	8	14	8
Atlantic City	13	30.01	30.01	+.03	30.65	8	29.25	29.14	46.3	0.7	84.0	11	54.1	26.6	2	40.0	57.4	44.0	10	3.7	18.2	40.9	2.85	-.05	7,033	nw.	37	ne.	18	13	6	13	11
Cape Henlopen	45	29.97	30.00	+.03	30.63	8	29.30	29.13	46.4	0.4	74.8	11	53.6	30.4	3	39.3	44.4	34.1	12	5.4	11.1	40.9	2.62	+.18	5,181	nw.	37	n.	13	13	6	13	11
Baltimore	45	29.97	30.00	+.03	30.63	8	29.30	29.13	51.2	1.8	85.0	11	61.2	29.5	6	41.8	55.3	38.2	10	7.4	15.89	35.7	2.44	-.07	4,963	n.	24	nw.	29	13	7	13	10
Ocean City	106	29.92	30.02	+.03	30.63	8	29.34	29.13	47.5	0.4	78.8	10	53.9	31.0	2	41.0	47.8	35.3	10	5.5	13.3	40.9	2.93	-.02	4,963	n.	32	nw.	29	14	8	12	10
Washington City	16	29.92	30.02	+.03	30.63	8	29.34	29.13	51.6	0.4	83.9	11	61.3	28.0	6	43.1	55.9	38.8	10	8.2	16.17	37.0	3.24	+.35	4,984	n.	32	nw.	29	14	8	12	10
Cape Henry	16	29.92	30.02	+.03	30.63	8	29.34	29.13	51.6	0.4	83.9	11	61.3	28.0	6	43.1	55.9	38.8	10	8.2	16.17	37.0	3.24	+.35	4,984	n.	32	nw.	29	14	8	12	10
Chincoteague	8	30.01	30.01	+.01	30.62	8	29.33	29.13	53.9	0.4	81.8	11	62.5	33.2	2	45.2	48.6	33.7	18	6.0	11.1	40.9	2.84	-.20	5,181	n.	32	nw.	29	14	8	12	10
Lynchburg	654	29.34	30.01	+.01	30.62	8	29.35	18.17	49.0	1.6	81.4	11	60.8	30.2	1	42.0	51.2	34.3	10	8.1	29.77	41.8	3.34	+.13	9,953	n.	50	n.	25	14	8	12	10
Norfolk	30	30.01	30.03	+.03	30.60	8	29.35	18.17	53.5	2.5	85.4	12	64.9	30.9	3	42.2	54.5	41.2	10	5.0	22.66	40.6	3.29	-.20	2,882	nw.	24	nw.	29	13	7	15	8
Norfolk	30	30.01	30.03	+.03	30.60	8	29.35	18.17	53.0	3.0	84.5	11	63.5	31.5	6	43.7	53.0	34.8	10	7.0	14.67	41.3	3.37	-.55	5,439	e.	32	sw.	28	12	9	11	10
South Atlantic States.																																	
Charlotte	808	29.30	30.03	+.03	30.53	8	29.38	18.16	61.8	1.0	89.3	13	71.4	33.1	2	48.0	57.2	36.3	3	6.6	16.61	46.7	1.84	-.20	4,284	sw.	35	sw.	18	9	4	11	15
Hatteras	11	30.06	30.05	+.05	30.56	8	29.52	29.10	57.0	0.0	75.6	13	64.5	36.7	2	50.4	38.9	23.3	19	7.4	17.8	50.0	2.71	-.21	11,666	sw.	47	w.	28	9	4	14	12
Kitty Hawk	9	30.06	30.05	+.05	30.56	8	29.52	29.10	55.3	0.0	80.0	13	64.2	33.2	2	46.4	46.8	35.0	4	5.6	10.1	40.9	2.39	-.15	5,181	sw.	47	w.	28	9	4	14	12
Raleigh	439	29.59	30.06	+.06	30.59	8	29.38	18.17	57.2	0.0	86.0	12	68.9	30.4	2	46.5	55.5	33.6	3	3.1	16.1	41.9	2.10	-.15	5,586	sw.	35	n.	29	8	7	8	15
Smithville	34	30.06	30.06	+.06	30.59	8	29.38	18.17	60.4	0.4	77.2	13	68.5	34.0	2	52.4	43.2	27.1	3	3.8	8.8	41.9	2.27	-.10	5,586	sw.	35	n.	29	8	7	8	15
Wash. Woods	58	30.00	30.03	+.03	30.49	9	29.53	18.06	54.4	0.0	80.0	13	62.8	30.0	6	46.1	50.0	32.0	18	5.0	14.1	40.9	2.90	-.06	5,586	sw.	35	n.	29	8	7	8	15
Wilmington	58	30.00	30.03	+.03	30.49	9	29.53	18.06	59.9	1.1	85.7	12	69.8	33.9	2	49.3	52.8	33.6	13	3.3	23.68	48.1	3.90	-.02	6,029	s.	30	s.	18	8	4	8	18
Charleston	53	30.03	30.04	+.04	30.45	9	29.58	18.06	62.6	1.4	85.3	12	71.7	33.4	2	55.5	51.9	37.1	11	7.8	22.73	52.5	3.53	-.02	6,783	sw.	30	s.	18	8	5	7	18
Augusta	183	29.89	30.05	+.05	30.49	9	29.51	18.06	63.4	0.6	92.6	12	72.7	39.2	2	49.2	53.4	43.7	12	6.0	16.5	49.8	3.77	-.12	3,985	w.	23	e.	18	6	2	10	18
Savannah	87	30.00	30.06	+.04	30.48	9	29.59	18.06	63.7	2.3	89.0	16	74.9	35.5	2	54.7	53.5	31.0	12	7.4	23.68	51.2	2.06	-.22	6,293	s.	32	e.	8	6	3	7	20
Jacksonville	43	30.04	30.05	+.03	30.33	9	29.57	18.06	67.0	2.0	88.7	19	77.3	37.6	2	54.2	54.1	36.7	2	7.0	24.74	56.9	4.15	+.87	5,178	no.	39	sw.	18	7	5	20	20
Florida Peninsula.	22	30.04	30.03	+.02	30.26	4	29.72	25.04	70.4	1.3	82.2	12	75.7	41.6	2	60.2	40.6	23.9	6	8.5	18.76	59.6	3.63	+.74	7,545	w.	28	s.	3	6	5	9	7
Cedar Keys	22	30.04	30.03	+.02	30.26	4	29.72	25.04	73.3	2.7	84.0	20	79.2	61.2	2	70.4	32.8	14.9	1	5.1	30.77	66.5	0.78	-.50	7,570	e.	38	n.	1	7	4	19	7
Key West	25	30.04	30.03	+.03	30.27	3	29.71	25.06	69.5	1.5	89.8	22	79.5	44.0	2	60.9	44.5	29.8	21	9.6	8.73	66.5	3.19	-.43	5,782	e.	34	n.	33	11	5	10	15
Sanford	25	30.04	30.03	+.03	30.27	3	29.71	25.06	66.1	1.1	88.1	12	73.1	36.3	2	60.3	51.8	33.2	11	13.2	29.50	41.8	1.38	-.36	7,913	nw.	37	w.	18	8	4	9	17
Atlantic Gulf States.																																	
Pensacola	30	30.03	30.04	+.04	30.34	9	29.68	18.06	67.2	0.8	92.0	20	75.5	44.4	2	60.0	47.6	26.0	12	2.5	23.74	58.0	0.95	-.43	5,428	s.	21	n.	28	4	2	12	16
Mobile	35	30.05	30.05	+.05	30.36	9	29.69	18.06	67.2	0.8	92.0	20	75.5	44.4	2	60.0	47.6	26.0	12	2.5													

Table of miscellaneous meteorological data for April, 1887—Signal Service observations—Continued.

Stations and districts.	Elevation above sea-level, feet.	Atmospheric pressure (in inches and hundredths).							Temperature of the air (in degrees Fahrenheit).												Winds.										
		Mean actual barometer.	Mean reduced barometer.	Departure from normal.	Extremes.			Monthly range of barometer.	Monthly mean.	Departure from normal.	Extremes.			Monthly range.	Daily ranges.			Mean relative humidity, per cent.	Mean temperature of the dew-point (degrees Fahrenheit).	Precipitation (in inches).	Departure from normal precipitation (in inches).	Total movement, miles.	Prevailing direction.	Maximum velocity.		Date.	No. of rainy days.	No. of cloudy days.	No. of fair days.	No. of clear days.	
					Highest barometer.	Date.	Lowest barometer.				Max.	Date.	Min.		Date.	Mean min.	Greatest.							Least.	Miles p. h.						Direction.
Upper Miss. Valley.																															
Saint Paul.	831	29.99	29.89	-.07	30.31	7	29.45	30.0.86	53.1 + 1.8	45.0 - 1.0	84.2 30	56.6	13.8 4	34.1 70.4 39.7	8	7.2 24 70.6	35.0	2.36 + 0.58	5.936 e. n.w.	29	n.w.	28	11	10	13	7					
La Crosse.	744	29.13	29.93	-.01	30.41	7	29.35	30.1.06	47.7 - 0.3	79.1 9	58.7	11.5 4	36.6 67.6 36.6	8	7.3 24 64.3	34.7	1.94 + 0.89	6.921 s.	40	n.	23	12	11	16	3						
Davenport.	615	29.28	29.93	-.04	30.34	7	29.27	30.1.06	52.3 + 2.3	82.2 13	64.4	16.4 4	40.9 65.8 36.0	2	12.3 16 56.8	35.7	1.17 + 1.78	7.752 s. s.w.	36	n.w.	28	7	4	19	7						
Des Moines.	866	29.00	29.92	-.01	30.32	4	29.28	30.1.04	50.5 + 2.5	86.8 8	64.4	18.1 4	40.8 68.7 45.4	8	8.4 7 58.5	36.5	2.48 + 0.50	6.177 s.w.	32	n.w.	28	7	6	11	11						
Dubuque.	665	29.22	29.93	-.04	30.38	5	29.21	30.1.17	50.7 + 2.7	82.6 13	62.0	15.8 4	39.0 66.8 37.8	8	11.9 23 63.6	37.8	1.37 + 1.54	3.977 s.	23	w.	28	7	3	16	11						
Keokuk.	618	29.29	29.94	-.01	30.35	5	29.33	30.1.03	53.0 + 1.6	83.9 13	66.5	22.1 4	41.8 61.8 44.1	3	15.2 17 59.9	38.1	1.84 + 1.17	8.532 s.	38	n.w.	3	9	5	13	12						
Cairo.	359	29.65	30.01	+.03	30.39	9	29.43	30.1.03	50.1 + 1.1	87.0 13	69.2	32.9 1	50.2 54.1 26.5	12	6.8 25 57.8	43.5	2.09 + 2.19	6.430 s.	35	s.	3	7	5	15	10						
Springfield.	644	29.30	29.98	-.06	30.37	5	29.40	30.1.07	55.2 + 2.2	84.5 13	66.4	26.0 4	43.0 58.5 41.3	4	9.2 16 62.8	41.5	2.89 + 0.72	8.246 s.	34	w.	23	8	3	13	12						
Saint Louis.	571	29.37	29.96	-.01	30.36	5	29.38	30.1.08	60.7 + 4.7	86.7 13	70.3	31.6 5	51.1 55.1 37.1	4	8.8 17 48.0	39.1	4.36 + 0.94	9.653 s.	40	n.w.	4	9	3	16	11						
Missouri Valley.																															
Lamar.	1,028								51.4 + 3.8									2.31 - 0.62													
Leavenworth.	842	29.06	29.94	-.01	30.37	4	29.34	30.1.03	57.3 + 3.3	87.2 30	70.0	26.4 4	46.0 60.5 49.3	3	7.2 21 58.8	40.7	1.99 + 1.72	6.805 s.	29	n.w.	3	8	4	16	10						
Omaha.	1,113	28.75	29.93	-.03	30.37	4	29.42	30.0.94	54.5 + 4.5	88.0 30	67.1	23.4 4	44.3 64.6 37.3	8	7.4 13 61.3	39.8	0.88 + 2.16	7.370 n.w.	36	n.	22	8	15	5	7						
Valentine.	2,614	27.17	29.88	-.07	30.41	4	29.21	30.1.20	47.1 + 3.1	89.2 30	60.1	13.6 22	35.4 75.6 46.2	30	3.0 16 56.7	30.0	2.52 + 1.13	10.340 n.w.	58	n.	22	9	6	17	7						
Huron.	1,307	28.49	29.89	-.07	30.36	4	29.23	30.1.14	47.1 + 2.1	94.1 8	60.5	15.8 4	35.1 78.3 45.6	29	9.5 15 61.3	32.2	3.72 + 1.00	8.158 n.w.	48	s.w.	8	15	8	14	8						
Yankton.	1,234	28.54	29.85	-.11	30.32	4	29.24	30.1.08	50.9 + 5.9	90.1 8	64.2	18.9 4	40.3 71.2 43.7	6	5.8 13 69.2	39.8	2.45 + 0.94	8.239 n.w.	46	s.	9	9	8	16	6						
Northern slope.																															
Fort Assinaboline.	2,600	27.07	29.92	-.04	30.36	22	29.46	29.0.90	44.5 + 2.2	85.5 24	60.3	21.4 4	33.8 57.3 36.2	4	8.8 11 48.8	25.9	1.64 + 0.68	9.595 s.w.	49	w.	27	8	5	23	2						
Fort Custer.	3,040	26.74	29.89	-.06	30.40	3	29.38	30.1.02	45.4 + 2.4	86.8 28	58.4	24.7 3	34.9 57.3 40.5	28	9.6 3 60.1	29.8	2.16 + 0.97	6.017 n.	41	n.w.	27	9	12	15	2						
Fort Maginnis.	4,320	25.46	29.88	-.06	30.32	22	29.39	29.0.93	41.1 + 3.1	76.2 28	51.9	18.5 4	32.6 57.7 32.7	4	7.5 18 56.8	25.6	2.16 + 1.36	8.717 n.w.	52	n.w.	30	14	15	14	1						
Helena.	4,069	25.74	29.90	-.04	30.40	22	29.47	29.0.94	42.4 + 0.4	74.0 28	52.2	21.7 4	32.2 52.3 37.3	4	7.9 21 70.3	32.6	1.93 + 0.50	5.865 s.w.	30	w.	2	9	15	14	1						
Poplar River.	2,002	27.76	29.90	-.09	30.39	3	29.33	30.1.06	43.1 + 2.1	87.3 29	56.6	12.0 3	39.8 75.3 47.4	28	11.1 11 68.3	32.2	0.31 + 0.48	7.423 s.	48	n.w.	30	4	21	5	1						
Deadwood.	4,600	25.27	29.94	-.05	30.44	3	29.42	30.1.02	41.2 + 1.2	73.4 7	50.6	15.8 4	33.5 57.9 30.1	7	6.0 19 71.5	31.8	6.47 + 1.45	3.700 s.w.	23	n.e.	20	15	8	13	9						
Cheyenne.	6,105	23.90	29.88	-.04	30.40	4	29.32	30.1.09	42.9 + 2.9	75.6 28	54.9	16.0 4	32.1 59.6 38.0	4	9.9 17 49.7	21.5	2.20 + 0.97	8.613 n.w.	44	n.w.	21	11	10	11	9						
Fort Laramie.									46.6	83.2 29	60.8	14.0 4	32.4 69.2 48.4	7	10.0 14		1.46		n. e.												
North Platte.	2,841	26.96	29.89	-.05	30.44	4	29.23	30.1.20	49.9 + 2.9	93.2 29	64.0	18.0 4	37.8 75.2 45.8	7	5.4 16 65.9	36.2	3.41 + 1.57	9.230 n.w.	52	s.	9	9	5	13	12						
Middle slope.																															
Denver.	5,294	24.65	29.85	-.03	30.41	4	29.28	30.1.13	53.5 + 2.5	82.5 29	60.3	20.5 24	36.3 62.0 42.2	4	8.1 15 47.1	25.5	2.82 + 0.50	6.755 s.	47	w.	21	10	8	14	8						
Pike's Peak.	14,134	17.64	29.84	-.01	30.44	19	29.46	30.0.90	48.7 + 1.7	82.5 29	60.3	20.5 24	36.3 62.0 42.2	4	8.1 15 47.1	25.5	2.82 + 0.50	6.755 s.	47	w.	21	10	8	14	8						
Las Animas.	3,899	25.94	29.84	-.01	30.44	4	29.30	30.1.14	51.8 + 1.8	87.4 7	67.1	21.3 4	37.7 60.1 53.8	7	8.1 18 73.2	42.0	2.55 + 1.34	7.215 w.	48	n.	22	10	6	17	7						
Concordia.	1,384	28.47	29.92	-.01	30.48	4	29.34	30.1.10	55.9 + 5.9	92.6 29	68.5	20.9 23	42.6 72.2 47.1	2	3.0 17 67.3	43.7	1.95 + 1.44		44	s.	9	8	6	9	15						
Dodge City.	2,523	27.34	29.95	+.03	30.50	4	29.40	30.1.10	54.4 + 2.4	91.1 29	68.1	23.1 4	41.6 67.2 53.1	6	1.7 17 55.1	34.3	2.46 + 1.16	8.576 s.	52	n.w.	22	9	5	7	18						
Fort Reno.									63.4	93.9 28	74.9	30.1 23	51.8 63.8				1.31	1.47													
Fort Supply.									59.6	93.4 29	73.5	31.0 1	45.6 62.4 49.2	3	5.8 13		3.26	0.61													
Fort Elliott.	2,700	27.20	29.88	+.08	30.35	4	29.38	30.1.07	55.9 + 0.9	90.2 29	70.6	29.0 23	43.0 61.2 51.3	6	8.1 17 58.6	38.8	6.06 + 4.48	10.369 n.w.	56	n.w.	22	9	6	9	15						
Southern slope.																															
Fort Sill.	1,200	28.73	29.95	+.03	30.45	4	29.47	30.1.08	59.5 + 0.8	95.0 29	76.3	35.0 4	49.8 60.0 45.6	3	7.7 17 59.8	46.4	1.19 - 0.14														
Arlene.	1,748	28.15	29.92	+.01	30.36	4	29.33	30.0.83	65.3 + 1.3	98.6 28	78.5	38.2 25	53.8 60.4 35.8	4	10.7 16 50.8	43.3	2.45 + 0.78	10.270 s.w.	48	n.w.	4	7	4	15	11						
Fort Davis.	4,428	25.13	29.87	-.02	30.30	4	29.52	30.0.77	61.3 + 1.3	86.3 29	76.5	34.7 23	43.4 75.6 40.3	2	20.8 16 30.5	23.3	0.20 + 0.33	6.571 s.w.	36	s.w.	12	2	1	6	23						
Fort Stanton.	6,150	23.90	29.77		30.21	4	29.44	30.1.07	45.7 - 1.3	75.0 28	64.8	21.2 25	33.6 56.8 45.4	26	15.3 21 43.3	23.2	0.04 - 0.73	6.331 n.w.	39	s.w.	11	1	1	7	22						
Southern plateau.																															
El Paso.	3,764	26.19	29.87	+.01	30.20	1	29.60	30.0.60	56.5 + 0.6	90.0 28	78.5	35.0 14	46.3 55.0 44.0	2	20.3 16 29.9	27.7	0.58 + 0.33	3.716 n.w.	23	s.w.	12	1	0	3	27						
Lava.									59.0	88.7 30	80.0	31.4 13	37.9 57.6				0.06	0.16													
Santa Fe.	7,026	23.20	29.90	+.01	30.21	4	29.58	30.0.64	46.8 + 0.8	72.2 28	59.6	23.4 13	33.9 48.8 34.0	26	12.5 8 39.6	20.4	0.74 + 0.66	3.103 s.w.	18	s.	10	5	3	10	17						
Fort Apache.	5,020	24.99	29.95	+.01	30.26	1	29.66	30.0.59	51.8 + 1.8	81.9 25	69.6	27.0 25	32.4 54.9 50.8	1	16.7 12 42.5	24.5	0.81 + 0.02	6.148 w.	42	s.w.	8	6	5	9	16						
Fort Bowie.									59.2	82.5 30	70.3	31.5 13	48.1 51.0				0.23	0.21													
Fort Grant.	4,910	25.18	29.95	+.01	30.15	13	29.75	30.0.40	56.8 - 0.2	80.9 28	68.1	28.1 13	45.9 52.8 29.3	28	13.7 16 33.0	23.2	0.30 + 0.13	5.747 w.	40	s.e.	15	4	2	9	19						
Fort McDowell.									60.0	80.8 28	84.0	38.0 1	48.1 60.0				0.68	0.49													
Fort Thomas.	2,710								60.9	91.0 7	78.8	33.5 1	43.0 57.5				0.31	0.15													
Fort Verde.									58.4	90.5 28	74.1	35.0 11	42.8 55.5				0.58	0.13													
Maricopa.									68.2	98.2 27	84.5	36.0 13	51.9 62.2				0.51	0.32													
Phoenix.									69.6	104.5 3	88.0	40.2 13	51.0 64.3				0.75	0.42													
Prescott.	5,399	24.68	29.93	+.02	30.21	1	29.67	30.0.54	49.7 + 0.7	78.6 28	63.6	23.0 12	36.0 55.0 42.0	2																	

Meteorological record of voluntary observers and Army post surgeons, April, 1887.

The maximum and minimum temperatures at stations marked thus (*) are from readings of other than standard instruments.

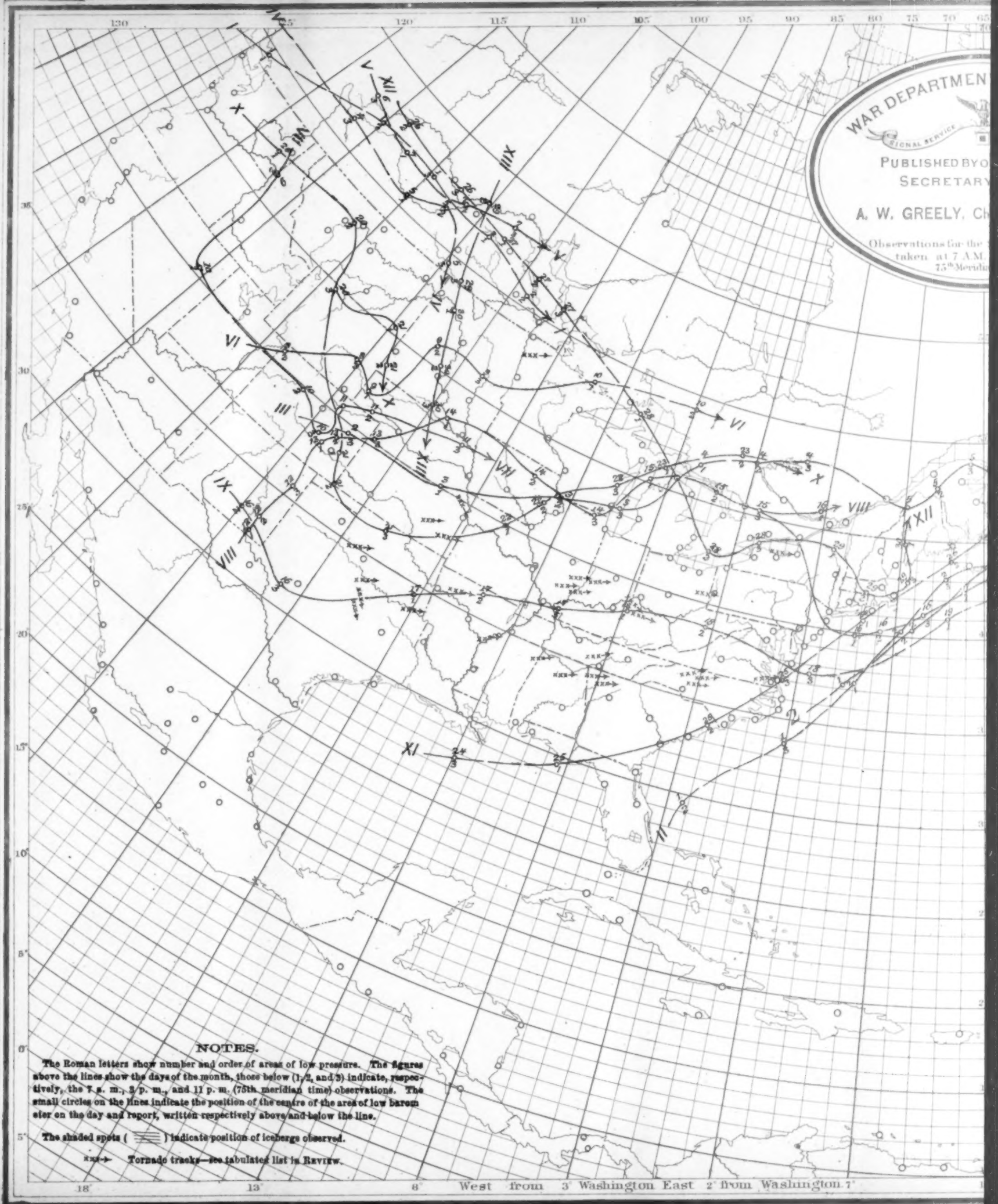
Stations.	Temperature. (Fahrenheit.)			Precipitation.	Stations.	Temperature. (Fahrenheit.)			Precipitation.
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.	
<i>Alabama.</i>				Inches	<i>Indiana—Cont'd.</i>				Inches
Greensborough.....	77	40	66.3	2.58	Lafayette.....	86	20	50.6	2.94
Livingston.....	88	39	66.0	2.58	Logansport*.....	88	22	53.1	2.10
Mount Vernon B'ks.....	92	41	68.3	0.7	Mauzy.....	83	21	47.6	3.86
<i>Arizona.</i>					Sunman*.....	88	24	51.8	5.18
Huachuca, Fort.....	78	34	56.0	0.68	Vevay.....	89	28	53.9	7.07
McDowell, Fort.....	97	42	68.6	0.68	<i>Iowa.</i>				
<i>Arkansas.</i>					Bancroft.....	86	12	46.3	2.10
Hot Springs.....	92	35	64.2	0.48	Cedar Rapids a.....	80	9	49.5	0.98
Lead Hill.....	90	27	64.0	3.02	Cedar Rapids b.....	80	14	49.8	0.58
<i>California.</i>					Clinton.....	87	18	50.9	1.21
Alcatraz Island.....	73	42	52.8	2.75	Cresco.....	80	13	46.3	1.94
Angel Island.....	84	40	55.4	1.95	Des Moines.....	83	17	51.9	1.86
Benicia Barracks.....	80	43	57.4	2.04	Independence*.....	74	17	48.7	1.86
Bidwell, Fort.....	77	21	46.4	1.52	Logan.....	94	22	55.3	1.40
Cahuenga.....	73	33	53.7	2.46	Fort Madison.....	86	22	50.6	0.83
Gaston, Fort.....	91	33	53.7	4.04	Monticello*.....	84	13	49.6	0.83
Mason, Fort.....	73	48	55.3	1.94	Mount Vernon.....	87	30	53.0	0.86
Nicolaus.....	86	42	60.7	2.22	Muscataine.....	84	16	50.8	1.28
Oakland.....	76	40	54.8	2.35	Oskaloosa a*.....	89	20	51.6	0.86
Oroville.....	86	38	62.1	2.81	Oskaloosa b*.....	83	22	50.0	0.86
Presidio of San F.....	76	36	53.7	1.80	<i>Kansas.</i>				
Princeton.....	84	35	57.2	1.70	Allison.....	86	28	52.0	3.29
Riverside*.....	90	43	64.1	1.71	Belleville.....	88	37	64.2	1.69
Sacramento.....	83	37	57.3	2.59	El Dorado.....	92	25	55.5	1.86
Salinas.....	70	40	51.8	1.63	Elk Falls.....	85	27	52.7	2.56
Santa Barbara.....	80	41	58.4	1.43	Emporia.....	86	24	50.3	2.61
<i>Colorado.</i>					Globe.....	86	24	50.3	2.61
Fort Collins.....	83	16	52.0	1.10	Hays, Fort.....	93	13	53.7	2.23
Lewis, Fort.....	72	20	43.3	1.20	Independence.....	92	27	59.8	3.23
Salida.....	80	8	44.0	1.20	Manhattan.....	89	23	57.0	2.50
<i>Connecticut.</i>					Marydale Farm*.....	93	22	56.6	1.84
North Colebrook.....	67	10	36.8	3.54	Ninnescah.....	95	24	58.8	3.31
Voluntown.....	84	22	53.0	3.30	Riley, Fort.....	93	21	59.0	1.04
<i>Dakota.</i>					Salina.....	97	34	58.1	2.60
Abr. Lincoln, Fort.....	91	3	41.0	1.24	Wakefield.....	96	31	58.9	1.47
Henry.....	85	14	44.6	3.75	Wellington.....	95	26	58.1	3.23
Meade, Fort.....	86	13	45.5	2.12	West Leavenworth.....	90	27	54.0	5.40
Parkston*.....	94	16	55.0	3.17	Wyandotte.....	86	29	57.6	3.30
Pembina, Fort.....	92	2	35.7	2.80	<i>Kentucky.</i>				
Randall, Fort.....	94	17	47.8	1.14	Frankfort.....	88	16	53.1	6.29
Siemon, Fort.....	91	2	37.0	2.80	Harper's Ferry.....	83	30	53.7	5.47
Sully, Fort.....	95	19	49.6	1.45	Midway.....	84	17	54.9	5.47
Totten, Fort.....	84	3	40.2	0.97	<i>Louisiana.</i>				
Webster.....	93	7	45.3	3.94	Grand Coteau.....	88	46	69.1	1.77
Yates, Fort.....	98	12	44.1	1.02	Liberty Hill.....	80	19	50.0	0.85
<i>District of Columbia.</i>					<i>Maine.</i>				
Distributing reservoir.....	89	31	53.6	3.83	Bar Harbor.....	65	19	44.0	4.81
Kendall Green.....	78	39	53.7	2.67	Cornish.....	70	14	38.9	3.85
Receiving reservoir.....	82	30	52.7	3.94	Kent's Hill.....	64	14	37.9	5.27
Rock Creek bridge.....	84	34	55.7	.....	Orono*.....	64	4	37.4	5.08
<i>Florida.</i>					<i>Maryland.</i>				
Alva.....	91	44	68.0	7.10	Cumberland.....	82	26	49.2	2.61
Archer.....	84	36	62.2	7.75	Fallston*.....	83	26	47.5	2.51
Dade.....	90	38	66.1	5.53	Great Falls.....	82	31	51.3	2.12
Fort Meade*.....	91	40	66.1	2.15	McDonough.....	81	26	54.2	2.50
Lincolnton.....	91	46	78.4	2.49	McHenry, Fort.....	82	30	52.8	0.95
Manatee*.....	89	50	73.8	5.07	New Midway*.....	84	25	51.3	2.62
Merritt's Island.....	80	20	70.4	8.24	Woodstock.....	84	25	49.0	2.55
Tallahassee.....	87	44	66.8	5.10	<i>Massachusetts.</i>				
<i>Georgia.</i>					Amherst.....	74	17	41.6	2.98
Athens.....	86	30	60.2	1.11	Blue Hill Obs'y.....	79	19	41.4	3.97
Forsyth*.....	91	38	66.6	3.33	Summit.....	80	21	44.4	4.44
Milledgeville.....	88	32	64.0	1.77	Deerfield.....	70	12	40.4	4.93
Quitman*.....	87	39	66.8	7.20	Dudley.....	80	18	43.2	3.15
<i>Idaho.</i>					Fall River.....	80	26	41.5	4.72
Boise Barracks.....	90	23	50.3	0.63	Heath.....	70	12	40.4	4.93
Lewiston.....	92	33	52.7	1.31	Milton.....	78	23	43.6	3.76
Sherman, Fort.....	72	33	44.5	2.82	New Bedford.....	76	21	43.1	5.46
<i>Illinois.</i>					North Truro.....	76	21	43.1	5.46
Collinsville.....	84	28	55.9	3.99	Somerset.....	82	22	45.3	4.29
Charleston*.....	90	20	53.4	2.60	Taunton.....	87	23	43.6	4.44
Geneseo.....	85	19	52.3	0.80	Williamstown.....	66	13	39.5	3.23
Jacksonville.....	83	22	54.3	1.50	Westborough.....	80	18	45.4	3.30
Mattoon*.....	89	22	53.9	2.93	Worcester.....	73	22	40.7	2.84
Pekin*.....	87	23	50.4	2.30	<i>Michigan.</i>				
Peoria*.....	90	28	57.3	1.53	Bay Port.....	70	14	40.0	0.62
Riley.....	81	18	47.0	1.55	Benton Harbor.....	82	25	47.3	0.62
Rockford.....	81	23	49.5	0.92	Birmingham.....	73	15	40.0	1.28
Sandwich.....	89	24	53.1	0.57	Brady, Fort.....	84	0	35.3	2.87
South Evanston.....	85	17	50.0	0.52	East Saginaw.....	76	16	44.8	1.78
Sycamore.....	83	22	48.3	1.08	Harrieville*.....	71	10	39.0	2.18
Windsor.....	86	23	52.4	2.34	Hudson*.....	82	16	40.0	1.34
<i>Indian Territory.</i>					Kalamazoo.....	76	18	47.0	1.33
Gibson, Fort.....	92	32	63.8	1.62	Lansing.....	77	16	45.3	0.98
Neno, Fort.....	93	37	62.6	0.89	Swartz Creek.....	76	15	43.7	1.56
Supply, Fort.....	94	26	57.7	1.64	Thornville*.....	76	20	44.9	1.46
<i>Indiana.</i>					Traverse City.....	69	14	40.0	0.98
Butterville*.....	90	28	55.1	5.20	<i>Minnesota.</i>				
Fort Wayne*.....	83	25	51.2	2.35	Minneapolis.....	80	15	44.4	3.76
Jeffersonville.....	86	23	55.3	7.63	Snelling, Fort.....	84	14	40.4	3.90
Laconia.....	92	18	51.8	5.68					

Meteorological record of voluntary observers, etc.—Continued.

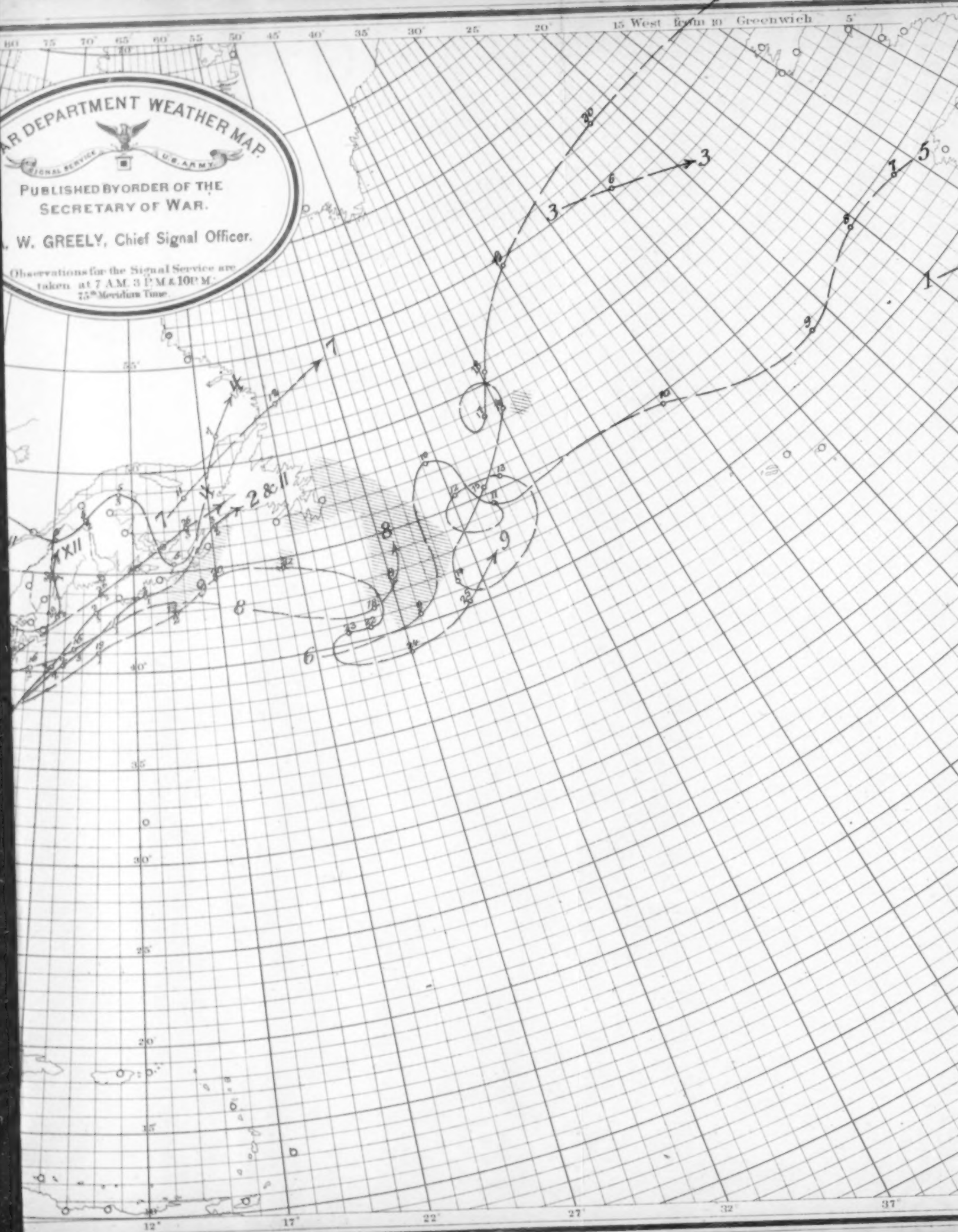
Stations.	Temperature. (Fahrenheit.)			Precipitation.	Stations.	Temperature. (Fahrenheit.)			Precipitation.
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.	
<i>Missouri.</i>					<i>Ohio—Cont'd.</i>				
Carthage.....	89	28	58.6	3.62	Tiffin a*.....	86	12	47.3	1.99
Central College.....	88	20	55.6	3.62	Tiffin b*.....	86	20	48.7	2.51
Centerville.....	85	20	52.5	1.56	Wauseon.....	84	17	46.2	1.52
Conception.....	83	29	54.3	1.50	West Milton*.....	90	24	61.0	6.06
Springfield*.....	90	22	59.4	2.80	Westerville.....	81	22	48.7	4.06
<i>Montana.</i>					<i>Yellow Springs.....</i>				
Keogh, Fort.....	85	19	48.5	1.08	Albany*.....	75	36	51.0	4.55
Missoula, Fort.....	70	30	45.2	1.95	Bandon*.....	60	40	48.9	6.47
Shaw, Fort.....	77	18	45.4	.....	East Portland*.....	68	30	49.3	3.00
<i>Nebraska.</i>					<i>Kola.....</i>				
Brownville*.....	89	26	57.0	1.40	Klamath, Fort.....	76	14	40.9	1.61
De Soto*.....	93	22	54.3	1.01	La Grande.....	76	26	50.0	1.29
Fremont*.....	88	23	52.9	1.38	Mount Angel.....	69	30	49.3	6.93
Genoa.....	91	21	52.7	2.26	<i>Pennsylvania.</i>				
Hay Springs.....	85	15	44.5	2.30	Altoona.....	80	28	54.0	2.35
Lincoln.....	86	21	54.8	0.53	Bethlehem.....	81	28	49.0	2.08
Marquette*.....	86	21	54.8	0.53	Blooming Grove.....	74	20	42.9	4.25
Niobrara, Fort.....	95	17	49.5	4.08	Drifton.....	78	17	42.2	3.02
Robinson, Fort.....	88	18	49.1	2.60	Dyberry.....	63	10	38.3	2.20
Sidney, Fort.....	85	15	48.2	0.41	Easton.....	81	20	47.4	2.25
Stockham.....	82	15	48.2	0.41	Fallsington*.....	81	30	47.4	2.61
Tecumseh*.....	88	30	55.6	2.15	Franklin*.....	76	10	42.4	3.00
<i>Nevada.</i>					<i>Germantown.....</i>				
Carson City.....	82	22	48.1	0.65	Grampian Hills*.....	78	18	44.0	3.26
McDermitt, Fort.....	79	17	43.5	3.06	Phillipsburg*.....	76	22	44.4	4.80
<i>New Hampshire.</i>					<i>Quakertown*.....</i>				
Ashland.....	83	29	48.0	2.60	State College.....	79	17	45.9	2.23
Belmont.....	83	29	48.0	2.60	Wellesborough*.....	76	15	40.9	2.42
Berlin Mills.....	70	9	39.5	2.22	West Chester.....	82	25	47.2	3.51
Bristol.....	83	29	48.0	2.60	Wilkesbarre.....	83	18	44.9	2.16
Lake Village.....	83	29	48.0	2.60	Wysox.....	77	21	49.1	2.10
Nashua.....	79	18	41.8	3.37	<i>South Carolina.</i>				
Wier's Bridge.....	79	18	41.8	3.37	Aiken.....	89	34	64.6	2.77
Wolfborough.....	83	29	48.0	2.60	Spartanburg*.....	91	44	59.2	trace
Woodstock.....	83	29	48.0	2.60	Stateburg*.....	87	30	61.4	1.81
<i>New Jersey.</i>					<i>Tennessee.</i>				
Beverly.....	83	29	48.0	2.60	Ashwood.....	85	34	59.3	1.65
Clayton.....	87	20	47.5	2.73	Milan.....	90	30	60.8	1.38
Dover.....	81	20	44.5	2.20	<i>Texas.</i>				
Egg Harbor City.....	84	25	46.5	3.77	Austin*.....	96	44	70.4	.....
Moorestown.....	81	26	47.3	2.42	Cleburne.....	90	28	65.0	2.34
Readington.....	86	30	51.5	2.83	Comfort*.....	98	34	68.0	0.34
Roseland.....	82	19	46.8	2.28	Concho, Fort.....	101	34	67.8	1.76
South Orange.....	82	27	46.8	2.28	Corsicana.....	101	34	67.8	1.76
Vineland.....	72	18	51.5	4.07	McIntosh, Fort.....	101	45	75.5	0.10
<i>New Mexico.</i>					<i>Midland.....</i>				
Bayard, Fort.....	87	27	55.9	0.01	New Ulm.....	93	43	68.9	0.17
Gallinas Spring.....	82	33	58.0	0.80	Ringold, Fort.....	107	45	76.3	0.14
Selden, Fort.....	95	31	62.0	0.00	Silver Falls.....	95	26	61.4	1.93
Union, Fort.....	76	13	49.8	1.91	<i>Vermont.</i>				
Wingate, Fort.....	73	25	47.3	0.90	Brattleborough.....	71	7	42.3	2.50
<i>New York.</i>					<i>Burlington.....</i>				
Auburn.....	74	22	43.5	1.66	Charlotte*.....	65	14	41.1	2.21
Brooklyn a.....	74	28	48.9	.....	.....	60	11	39.0	3.10
Brooklyn b.....	79	27	46.9	3.12	Lunenburg.....	62	8	35.9	1.75
Cooperstown*.....	66	13	38.5	2.42	Newport.....	65	4	30.2	2.77
Factoryville*.....	78	20	42.9	1.45	Straford.....	60	12	37.6	2.50
Humphrey.....	68	16	40.3	3.10	<i>Virginia.</i>				
Ithaca.....	75	20	42.4	1.52	Bird's Nest*.....	81	32	52.7	2.80
Le Roy.....	72	18	42.1	2.25	Brington.....	80	22	52.0	2.51
Madison Barracks.....	67	17	39.5	1.96	Dale Enterprise*.....	87	27	54.3	5.21
Menands.....	67	23	42.3	2.89	Marion.....	84	26	49.0	4.20
Niagara, Fort.....	71	18	41.8	0.21	Monroe, Fort.....	79	30	52.9	3.15
North Volney*.....	73	21	40.6	.....	Rappahannock.....	83	28	50.1	5.51
Palermo*.....	66	21	38.9	1.12	Summit.....	83	24	50.2	.....
Palmyra*.....	78	25	46.0	.....	University of Va.....	74	33	53.1	3.01
Penn Yan.....	.....	.....	.....	1.56	Variety Mills.....	83	23	51.2	3.11
Plattsburg Barracks.....	66	9	38.0	0.37	Wayhville.....	81	27	52.0	2.98
Setauket.....	76	20	45.2	3.95	<i>Washington Territory.</i>				
Utica.....	73	15	36.1	.....	Blakely*.....	78	31	49.5	3.66
West Point.....	78	20	44.5	3.30	Kenewick.....	88	27	53.9	0.44
White Plains.....	76	30	47.9	4.48	Spokane, Fort.....	79	17	48.4	3.20
<i>North Carolina.</i>					<i>Tacoma.....</i>				
Chapel Hill.....	91	28	58.3	2.56	Townsend, Fort.....	63	29	47.9	0.90
Flat Rock.....	81	30	55.4	3.89	Walla Walla, Fort.....	82	29	52.7	1.08
Lenoir.....	.....	29	.....	3.80	<i>West Virginia.</i>				
Lincolnton.....	75	32	55.1	2.16	Clarkburg.....	80	18	51.4	3.42
Raleigh.....	88	34	59.0	1.70	Helvetia.....	74	20	47.7	4.91
Reidsville.....	92	23	55.7	3.18	Middlebrook.....	76	16	43.0	.....
Stateville*.....	87	30	56.9	2.72	Parkersburg.....	84	27	50.1	5.00
Weldon*.....	83	32	55.1	1.92	<i>Wisconsin.</i>				
<i>Ohio.</i>					<i>Beloit.....</i>				
Cleveland.....	76	19	45.8	2.31	Delavan.....	82	26	47.7	1.08
College Hill*.....	85	28	56.4	6.00	Embarras.....	78	6	43.9	2.70
Elyria.....	79	13	55.6	2.88	Fond du Lac.....	77	20	44.0	0.61
Garrettsville.....	81	10	44.1	3.39	Franklin.....	.....	.....	.....	0.50
Hiram.....	80	16	44.8	3.98	Madison.....	86	12	46.3	0.96
Jacksonborough*.....	86	22	52.1	5.05	Manitowoc.....	76	14	42.8	0.96
Napoleon.....	82	14	48.5	1.94	Prairie du Chien.....	81	17	49.0	2.14
North Lewisburg.....	86	22	52.7	3.70	Wausau.....	78	3	41.3	2.78
Portsmouth.....	88	26	52.5	6.01	<i>Wyoming.</i>				
Burgles*.....	83	20	43.5	3.75	Camp Sheridan.....	70	13	36.9	.....
					<i>Laramie, Fort.....</i>				
					83 16 46.4 0.57				

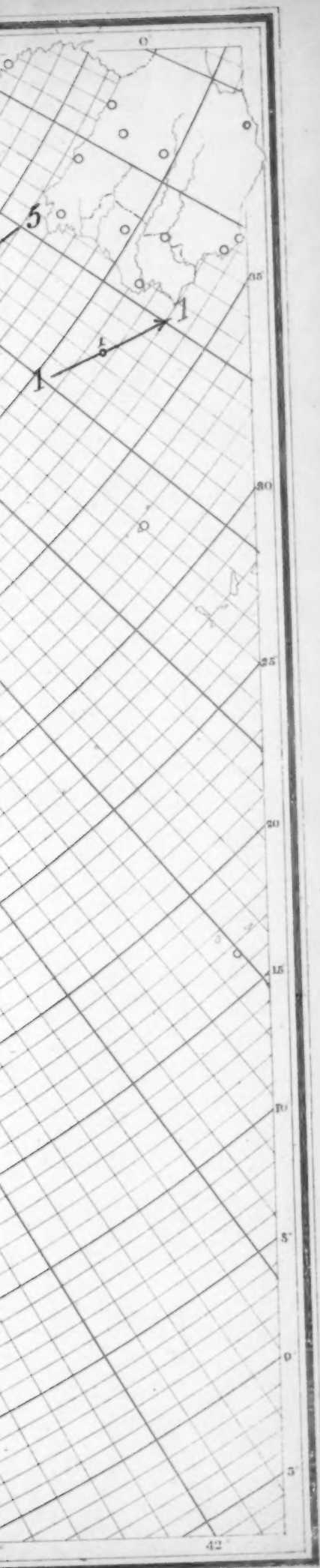
Chart I. Tracks of Areas of

Form 106 G 1884.



Areas of Low Pressure. April, 1887.





Received of the Treasurer of the
Board of Directors of the
City of New York
the sum of \$100.00
for the purchase of
the City of New York
the sum of \$100.00
for the purchase of
the City of New York

Form 106 F.



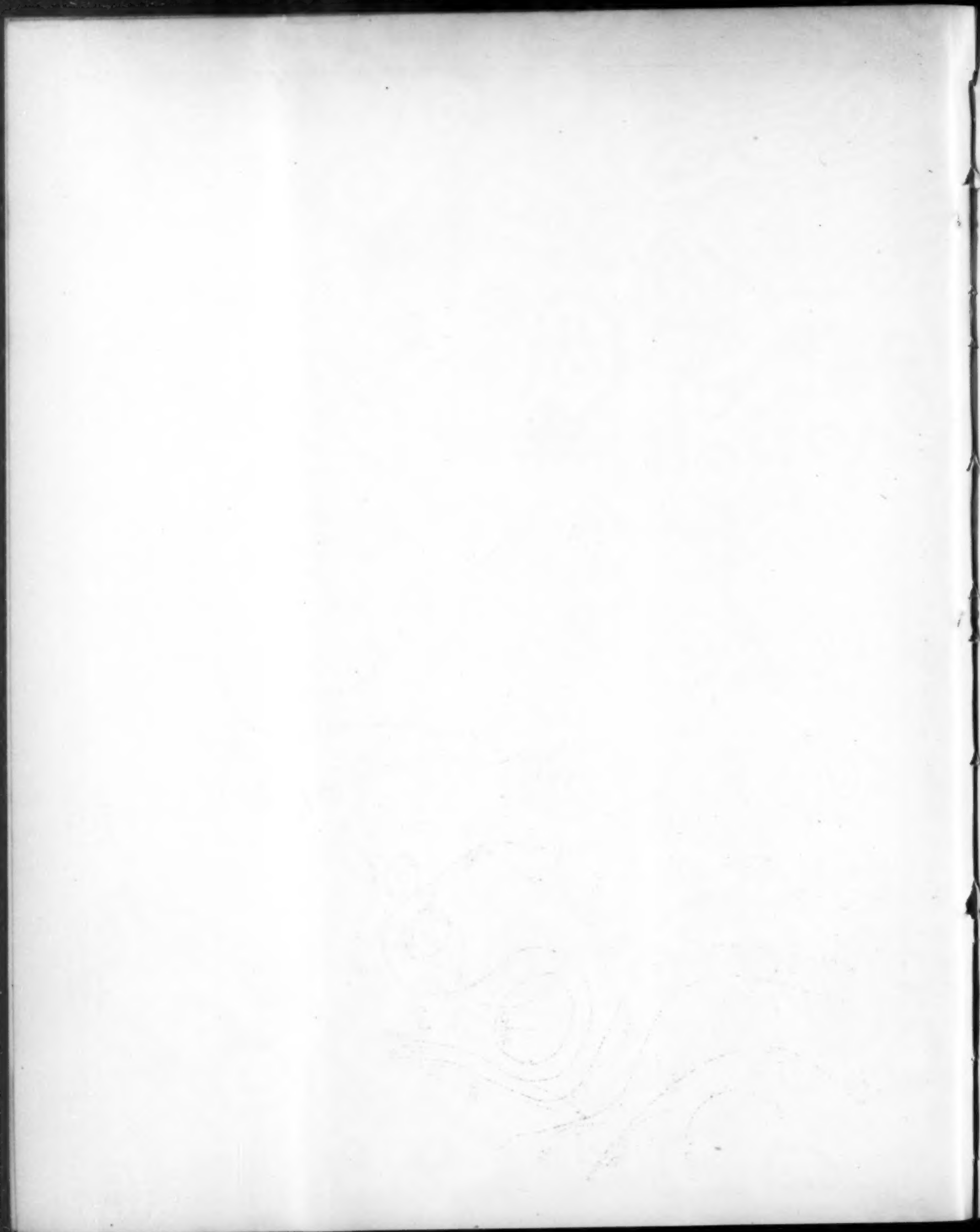
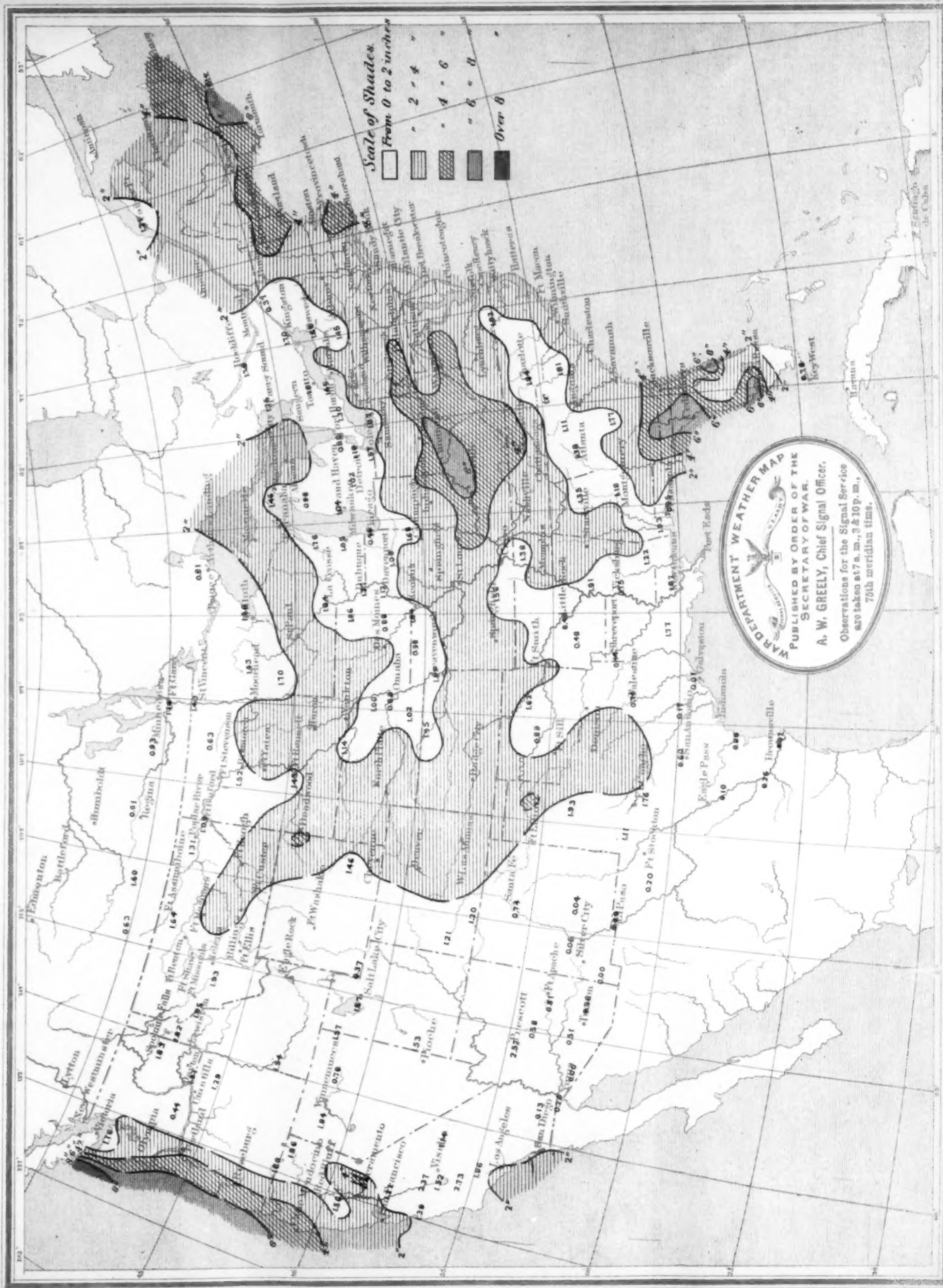


Chart III. Precipitation, April, 1887.

Form 106 F.



NAVY DEPARTMENT WEATHER MAP
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 Observations for the Signal Service
 are taken at 7 a. m., 3 & 10 p. m.,
 75th meridian time.

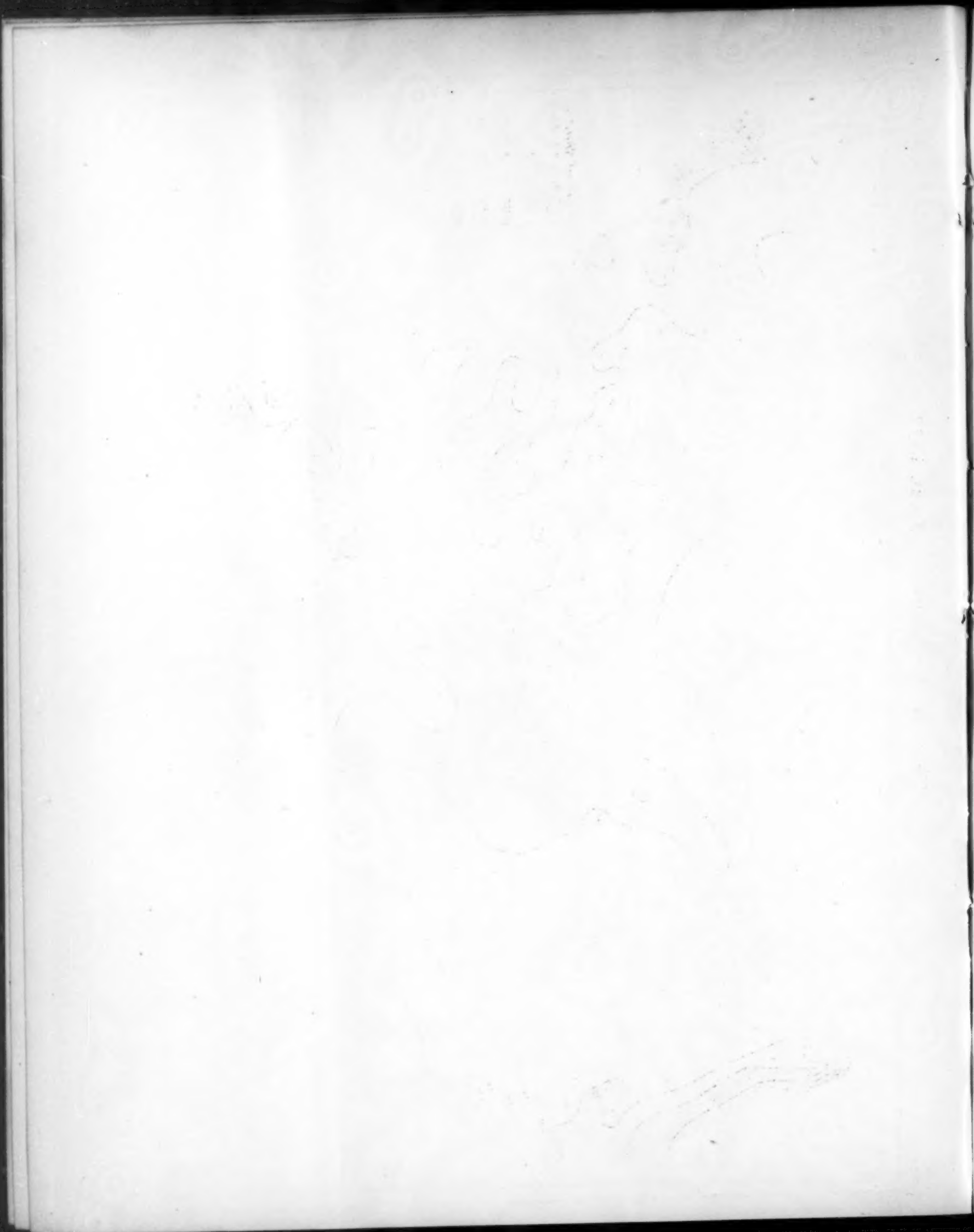


Chart IV. Departures from Normal Atmospheric Pressure and Temperature. April, 1887.

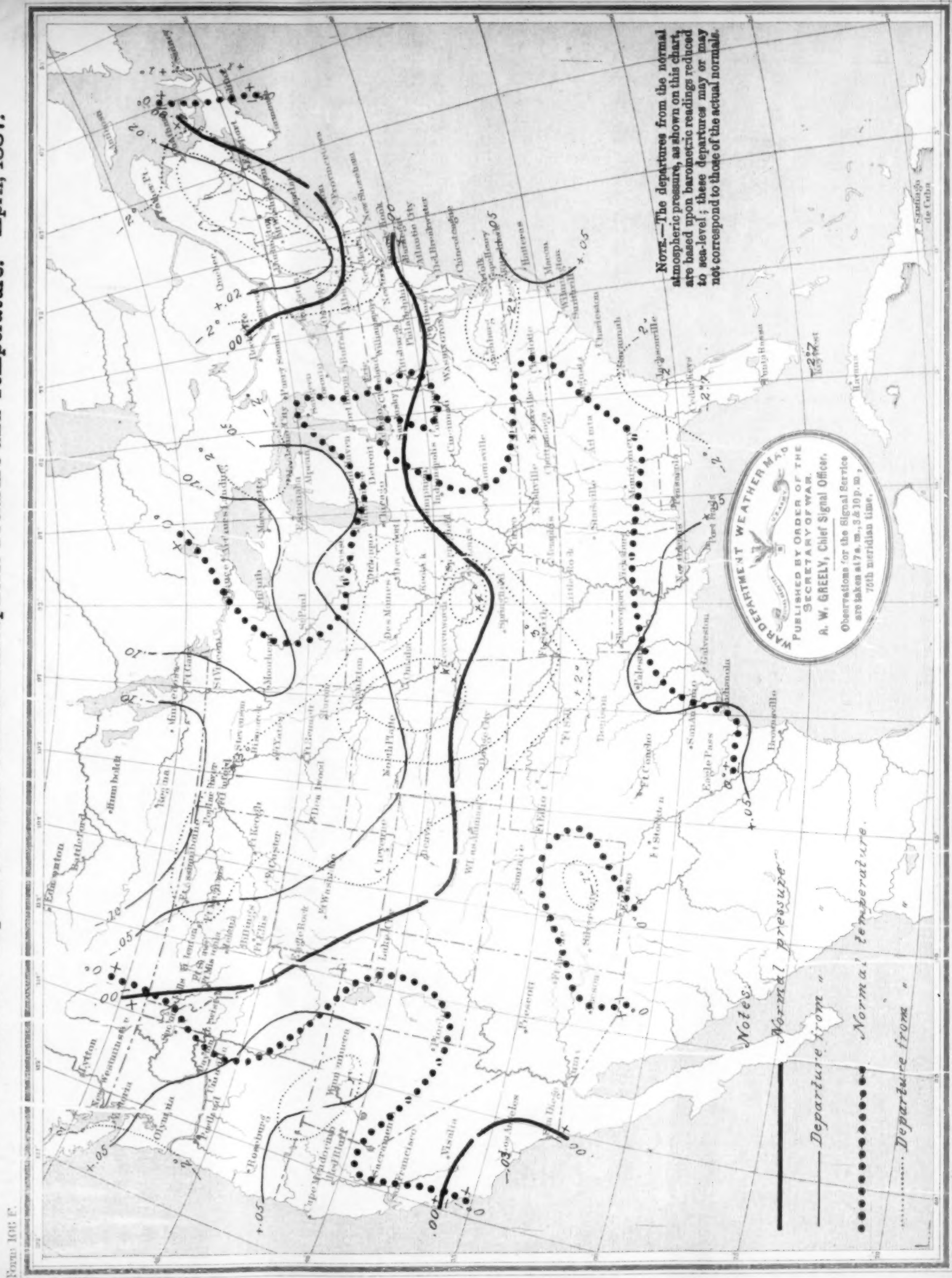


Chart V. Pressure (——) and Temperature (.....) Curves. April, 1887.

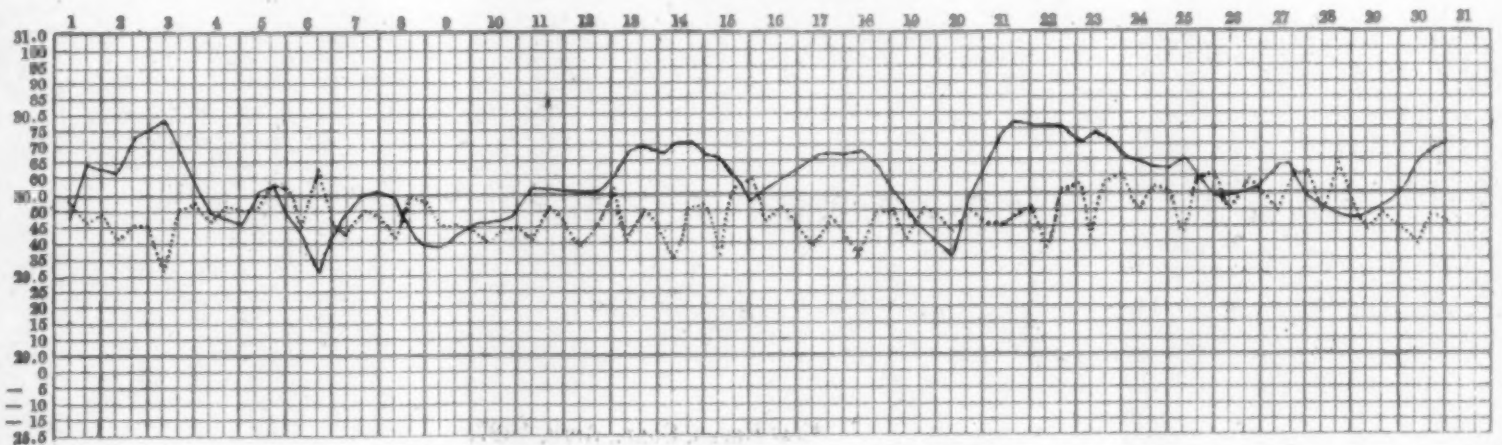
BOSTON, MASS.



SAINT PAUL, MINN.



PORTLAND, OREG.



NEW ORLEANS, LA.

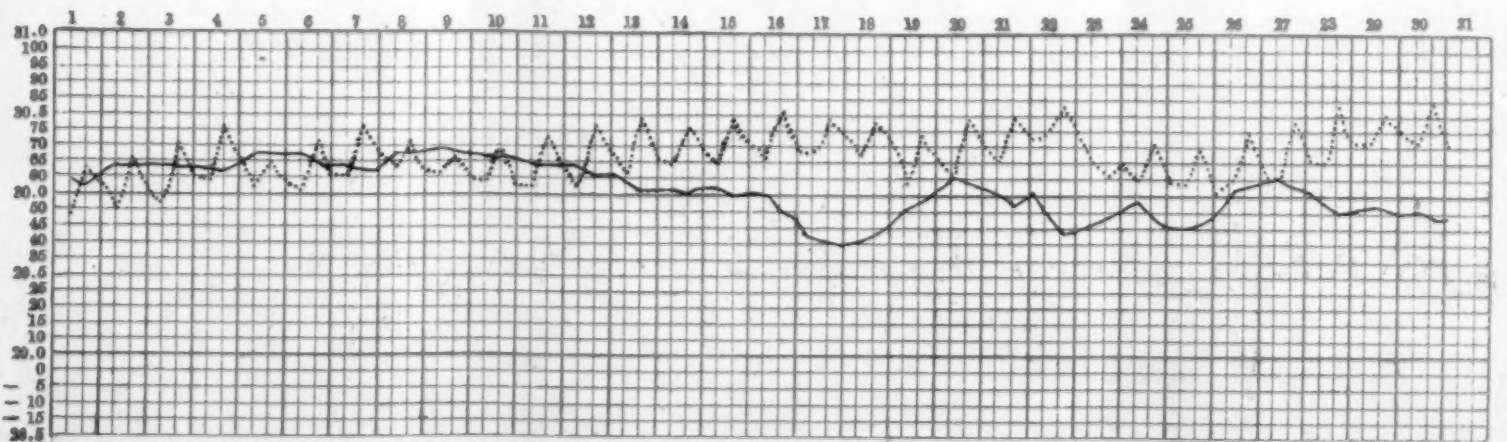
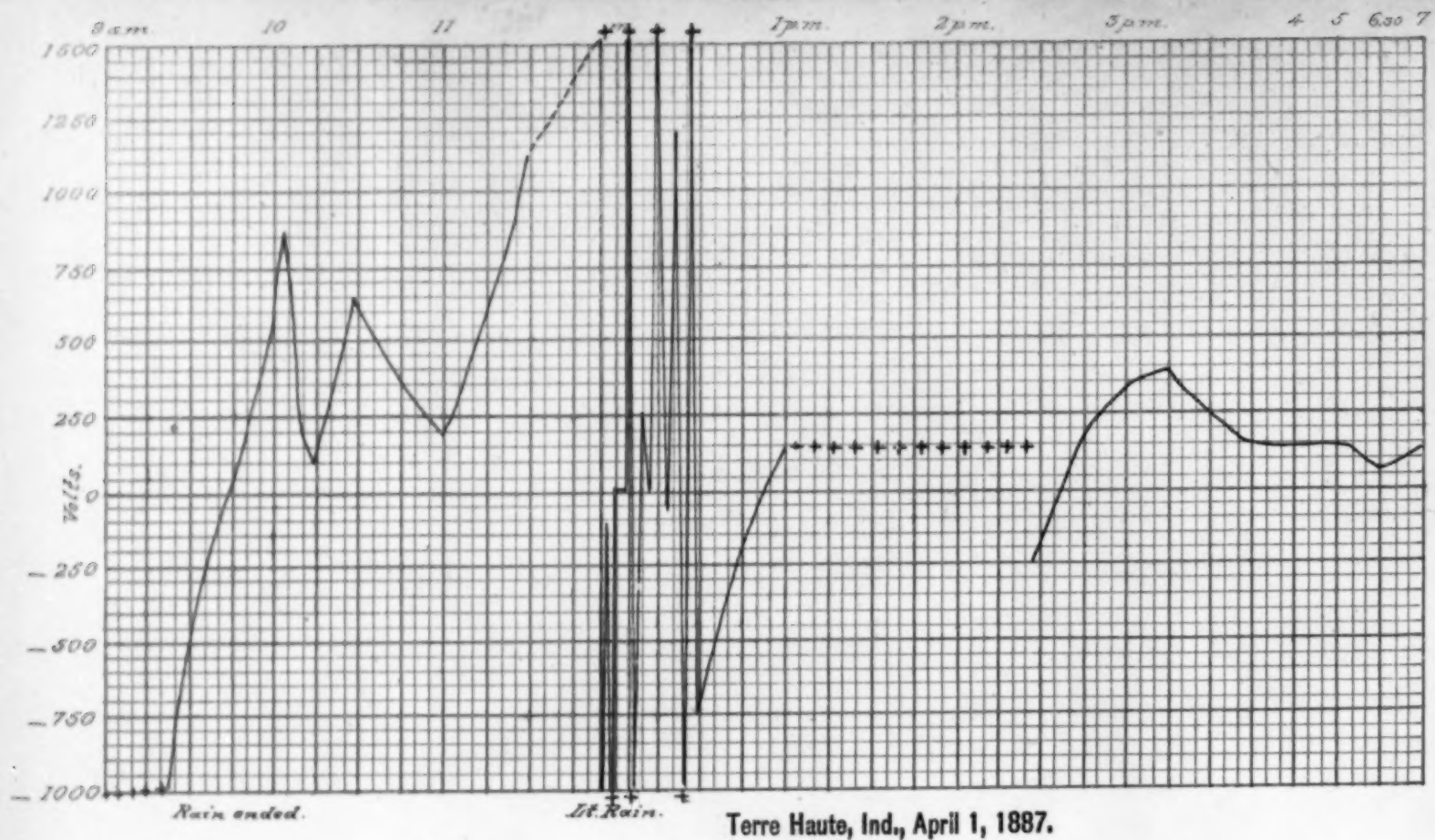


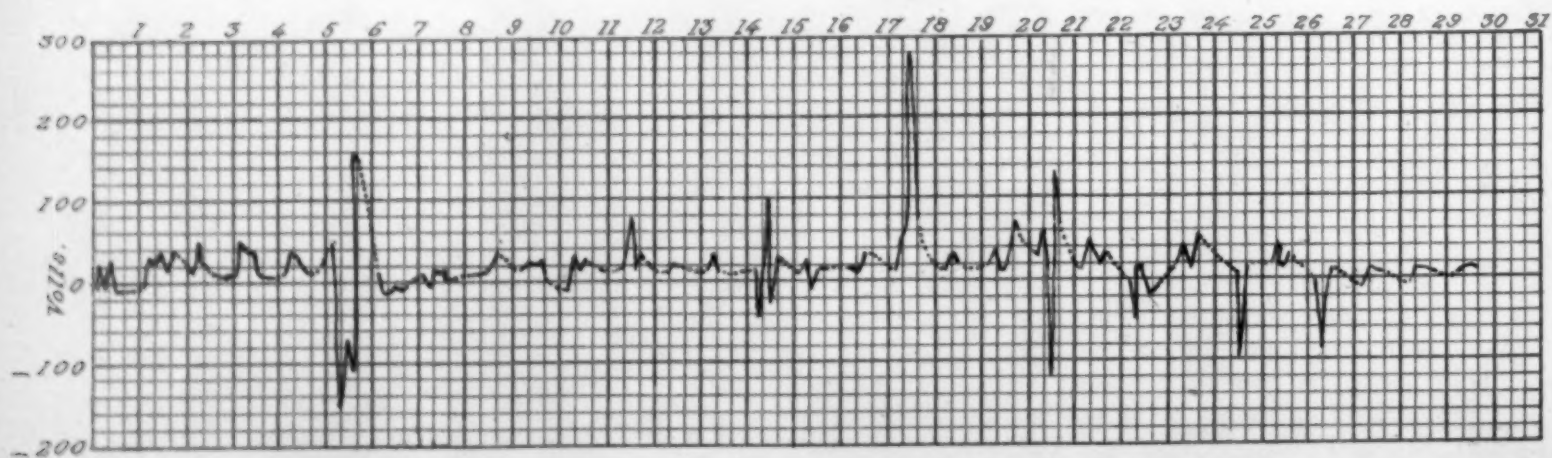
Chart VI. Curves showing Electrometer Readings.



Terre Haute, Ind., April 1, 1887.



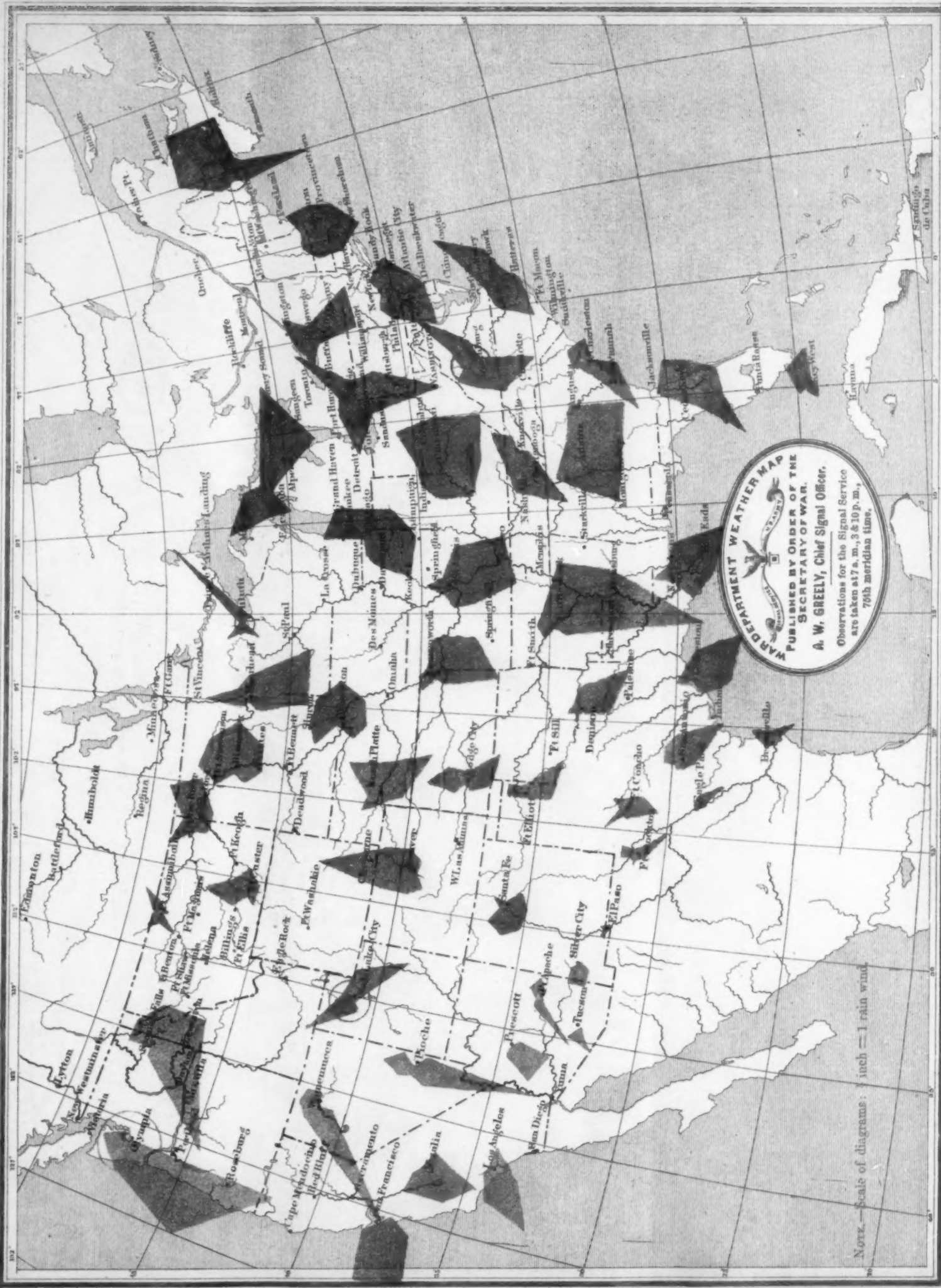
New Haven, Conn., April, 1887.



Boston, Mass., April, 1887.

Chart VII. Rain Frequency and Wind Rose for April.

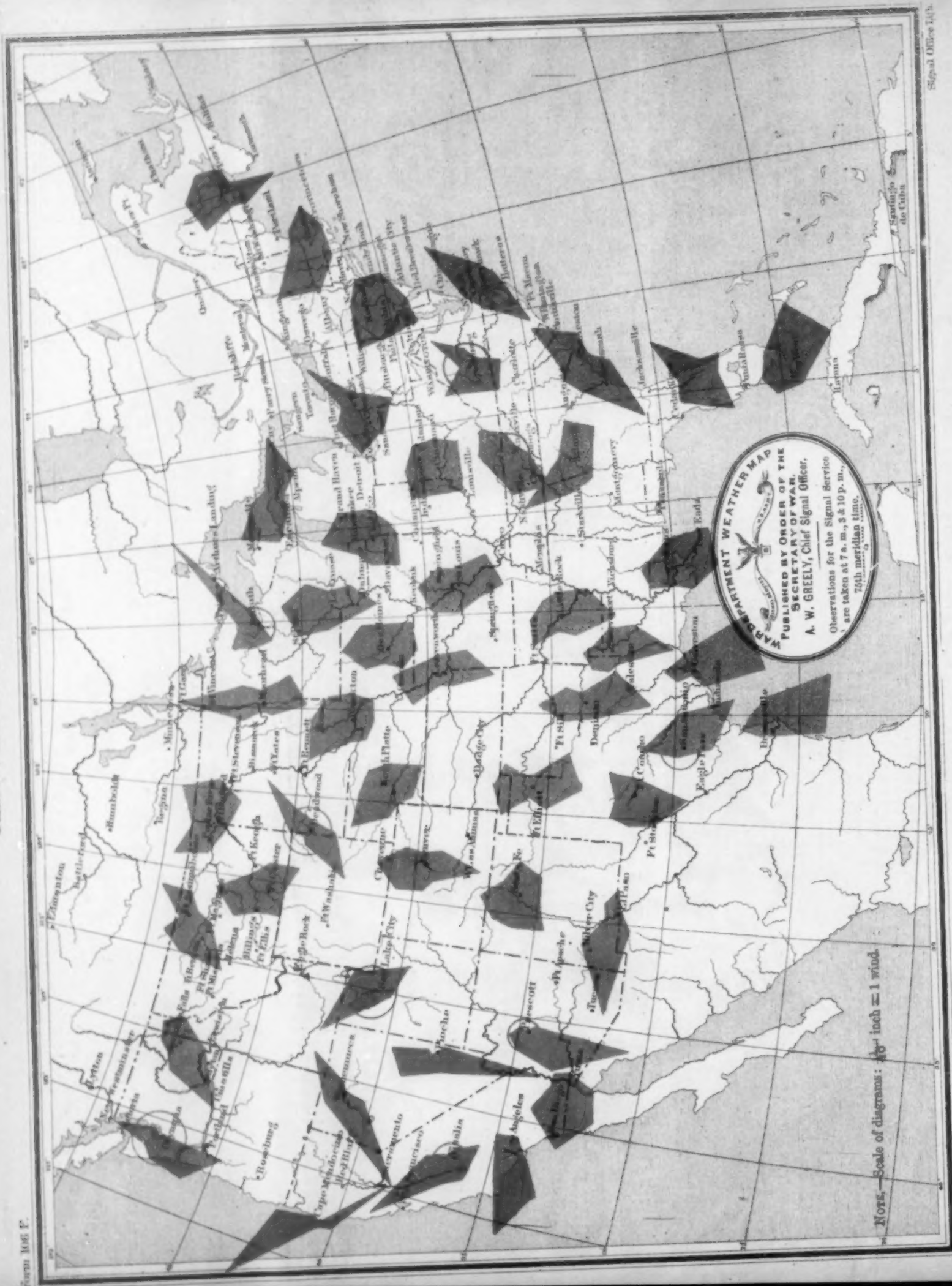
Form 106 F.



NOTE.—Scale of diagrams: 1 inch = 1 rain wind.

Chart VIII. Wind Rose for April.

Form 105 E.



WAR DEPARTMENT WEATHER MAP
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 Observations for the Signal Service
 are taken at 7 a. m., 3 & 10 p. m.,
 70th meridian time.

Note.—Scale of diagrams: 1/16 inch = 1 wind.

Signal Office 1473.

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A. Lincoln, Fort, Dak.	Hays, Fort, Kans.	Mason, Fort, Cal.	Niobrara, Fort, Nebr.	Sisseton, Fort, Dak.	Union, Fort, N. Mex.
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Concho, Fort, Texas.	Laramie, Fort, Wyo.	McHenry, Fort, Md.	Randall, Fort, Dak.	Spokane Fort, Wash.	
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